REANIMATING THE MACHINE

ROY SMALL MLA THESIS 2013 RHODE ISLAND SCHOOL OF DESIGN

REANIMATING THE MACHINE

A thesis presented in partial fulfillment of the
requirements for the degree Master of Landscape
Architecture in the Department of Landscape
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Providence, Rhode Island.

by Roy Small, 2013

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“Order stormed the surface
Where chaos set the norm.
Had there always been balance?
...Surely not.

Therein lies the beauty.”

—Mikael Stanne, *Therein*

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GLOSSARY OF TERMS

Industrial Symbiosis — The exchange of materials wherein one industry’s waste by-product is consumed and used as a raw material by another. Defined by Marian Chertow, Director of the Industrial Environmental Management Program at the Yale School of Forestry and Environmental Studies, as, ”Traditionally separate industries in a collective approach to competitive advantage involving physical exchange of materials, energy, water, and by-products.”[1]

Connective Tissue — infrastructure that facilitates the movement of people and/or tangible goods.

Deindustrialized Site(s) — a site or collection of sites that, in the past, had been used for industrial activity but no longer is/are; the industrial infrastructure remains and no new use has yet been implemented.

Industrial Infrastructure — the physical infrastructure that facilitates or facilitated industrial activity; rail tracks, bridges, cranes, blast furnaces, and other machinery and the factory buildings that housed them all.

Industrial Activity — man-made processes that contribute to the production of tangible goods or energy or the transportation of large quantities of tangible goods or energy.

Raceway (or Millrace) — a sluice that diverts water from a primary canal or other water artery to a mill building’s machinery.

Sluice — a constructed conduit that controls waterflow by means of a gate that mechanically opens and closes.

Urban Core — a central district within a city; not necessarily “downtown” but at least within close proximity close to it.

STATEMENTS + INTRODUCTION

> “America must absorb and apply effectively the **new possibilities for industrial production**—or lose its technological base and hold on its markets.”
>
> —University of California at Berkeley Professors Stephen S. Cohen (regional planning, international economics) and John Zysman (political science), *Manufacturing Matters*

STATEMENT

Alterations and augmentations to the existing landscape infrastructure of a depressed city center reactivate symbiotic industrial and recreational activity as the crux of an economic revitalization strategy.

ABSTRACT

Former industrial sites were often strategically chosen because of their access and ability to exploit nearby natural resources as a source of power or as a material for use in mass production. The landscapes that hosted these developments were manipulated beyond recognition as a means to achieve maximum industrial productivity. While such activity initially provided a substantial economic base upon which urban development and employment could grow, human consideration remained narrow and short-term. The resultant processes not only wreaked havoc on their natural surroundings but also eventually collapsed under increased economic pressure, leading to widespread unemployment, increased poverty, and population decrease.

Current efforts to rehabilitate deindustrialized sites most often seek to restore the health of degraded natural systems and to sometimes preserve the infrastructural relics of industry. In some instances, these efforts provide an economic boost to their locale, but in most cases do little to offset the economic/job losses incurred by deindustrialization. Furthermore, these efforts are most often applied to discrete, infrastructurally self-contained sites such as large factories or landfills that possess clearly articulated boundaries between themselves and any surrounding urban fabric that may exist. Deindustrialized areas that consist of smaller, disparate sites that are more closely embedded within the urban fabric of a city center tend to receive less attention.

This thesis seeks to sow the seeds of economic revitalization by altering an urban landscape as a means to facilitate the development of a recreational, industrially-driven program in a city that has become depressed in the wake of substantial deindustrialization. It is predicated on the notion that not every city center hard-hit by deindustrialization will be able to reinvent itself strictly through the establishment of artist's lofts, historic preservation parks, or social media start-ups, nor that they necessarily should be. It postulates that industrial activity is economically important, worth maintaining where it exists, and worth attempting to re-establish in a manner that is not only ecologically sensitive and economically sustainable but that also creates unique recreational opportunities for human engagement.

INTRODUCTION

Industrial sites of the past typically functioned according to a rather narrow focus: maximum mechanized output for maximum capital gain coupled with a general disregard towards other factors such as public health, environment, and economic stability. This attitude enabled specific industries to consolidate themselves in their given city or region, stifling diversity in the local economy, and spurring the fall into decline and dilapidation to hit all that much harder when it finally arrived.

Such sites have undergone years of deterioration and neglect but there is currently an ongoing renaissance to remediate and transform them—most often into public parks, community recreation centers, and indoor/outdoor museums or historic preservation centers. These spaces improve the quality of life for the people who live near them; pollutants are removed or capped and new amenities are created that benefit the local population. Sometimes, in the case of larger, tourism-driven parks such as the regionally-scaled IBA Emscher Park and its hallmark achievement, Landschaftspark Duisburg-Nord, a large number of new jobs are also created.

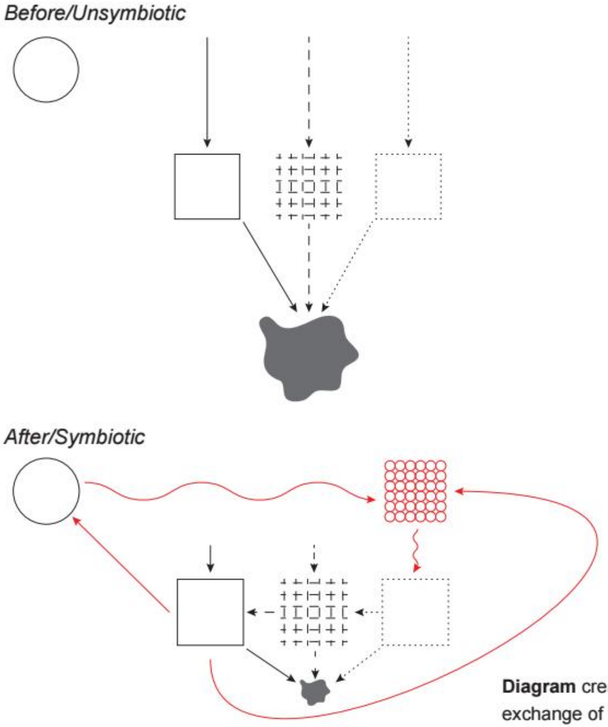
However, for city centers, the majority of post-industrial, landscape rehabilitation efforts tend to be isolated affairs with impacts analogous to a “drop in the bucket,” such as the Heritage State Parks scattered throughout the Commonwealth of Massachusetts or the Steel Yard in Providence, Rhode Island. While certainly a step in the right direction, the benefits that these projects provide tend to be more immediate and smaller in scale rather than comprehensive and targeted towards the problems of the larger, post-industrial urban context in which they are sited. More comprehensive, large-scale projects such as the Lowell National Historical Park have succeeded in reversing the trend towards ruination but remain plagued with some of the economic ghosts of deindustrialization (abandoned/vacant buildings, absence of a vibrant public realm). Lowell NHP’s particular case also requires ongoing federal funding to remain operational and should be seen as a solitary achievement rather than an ideal, self-supporting model towards which other hard-hit urban cores should strive.

Additionally, with very few exceptions such as the Steel Yard, these types of projects tend to avoid the possibility of reestablishing some sort of industrial role for the site (and in the Steel Yard's case, it could even be argued that its role is more arts-driven than industrially-driven). In some instances this approach would obviously not make sense—an abandoned mine depleted of its ore would not be a suitable site for reestablishing mining operations. Some sites' former industries are simply dead and never coming back. But other sites were built around naturally renewable resources such as timber or water current, and this is often the case with the former industrial sites that are found in city centers. Tapping into these renewable resources and other potentially beneficial contextual factors in an appropriate manner in an effort to expand and/or reestablish some sort of industrial production would prove to be a larger boon to a community adversely affected by the departure of its former industrial economic base than a park or cultural center alone would.

Underlying this assertion is the notion that industrial production is important as a source of wealth-generation and employment. In their introduction to *Manufacturing Matters*, University of California at Berkeley Professors Stephen S. Cohen (regional planning, international economics) and John Zysman (political science), write that "manufacturing is critical to the health of the economy; lose manufacturing and you will lose—not develop—high-wage service jobs." The expansion and/or reestablishment of industrial processes in a substantially deindustrialized context would benefit the local community if done in an innovative and ecologically sensitive manner.

This thesis therefore seeks to expand and/or reestablish industrial productivity as the primary means towards initiating the economic revitalization of an urban community devastated by the effects of deindustrialization. It intends to do this by creating an infrastructural platform that is attractive to industrially symbiotic development (see the Glossary of Terms on page 3 for a specific definition of industrial symbiosis).

This strategy is informed by previous studies that investigated the successes and failures of prior industrial symbiosis projects with the



Before/Unsymbiotic

After/Symbiotic

Diagram created by the author that illustrates the exchange of flows of materials and the accumulation of associated waste in pre- and post-symbiotic systems.

associated understanding that pre-selected industrial functions cannot be imposed newly from the top-down on a given site and be expected to thrive. The reality is that industrial firms need to be allowed a large measure of self-organization to effectively achieve and sustain symbiosis. The precursors to potential industrial symbiosis should be identified and nurtured (Chertow, 2007).

In terms of urban planning, the goal of this thesis is therefore to transform critical portions of a deindustrialized, urban landscape so that it becomes a flexible catalyst of and facilitator for potentially symbiotic industrial exchanges to take root. Because industrial symbiosis can be expected to take root and succeed only if the precursors are first identified, site context and analysis become crucial components of the strategy. Particular consideration is given to the identification of existing renewable, natural resources as well as any remaining industrial activities and flows that exist within or in close proximity to the chosen site. Where relevant and potentially beneficial, this contextual focus also expands to include investigation into both industrial and non-industrial activity occurring outside of, but still within, close proximity to the selected site's urban core.

In terms of landscape architecture, the design of this re-industrialized urban landscape responds to the conditions of the proposed platform for cultivating industrial symbiosis. A robust connective tissue emerges that increases the efficiency and ecological sensitivity of the flows of energy, manufactured products, and people. The form of this connective system allows for and encourages people to move among and experience the new industrial flows, thereby creating a new, appealing, and unique public realm.

In the midst of its own economically and environmentally sustainable re-industrialization, the urban landscape becomes an interactive platform for recreational and educational public experiences. In the end, the spirit of the industrial urban machine reawakens and provides people with an opportunity to engage with its reanimated skeleton.

PRECEDENTS

> “Turning waste into energy, the ecology of industries that emerged over three decades became an **icon of post-modern industrialism** recognized universally.”
>
> —Pierre Bélanger, Associate Professor in Landscape Architecture at Harvard GSD, *Wasteland: A Visual Reportage of the Kalundborg’s Waste Recycling Network in Denmark*

THE KALUNDBORG SYMBIOSIS KALUNDBORG, DENMARK

Kalundborg, Denmark plays host to the world's first working system of industrial symbiosis. The Kalundborg model has been well studied but attempts to replicate it tend to fail. This is due in large part to Kalundborg's unique genesis; the cooperating industries began to work together of their own accord in response to increased regulations regarding surface water usage and pollution limitations that the Danish government introduced in the 1970s. Marian Chertow's research has illustrated that it is the Kalundborg industries' ability to self-organize that allows their symbiosis to succeed. Replication efforts have generally failed because of their top-down approach that emphasizes the establishment of new industrial activities without giving proper regard to the existing context. Rather than attempting to impose an idealized symbiosis that may have no substantial connection to its allocated site, the seeds of existing or potential symbiosis should instead be identified and nurtured.

Kalundborg's symbiosis involves a powerplant, an oil refinery, a pharmaceutical company, a plasterboard manufacturer, and a soil remediation company.

ELEMENTS OF RELEVANCE + INSPIRATION

- World's first and most well-known working example of industrial symbiosis.
- The symbiosis utilizes a renewable natural resource (water) in a responsible manner.

ELEMENTS OF CRITICISM/INCONGRUITY

- Occurred of its own accord rather than through intentional plans or designs.
- Location is not particularly urban.
- Location did not suffer the effects of deindustrialization as is pertinent to the topic of this thesis.
- Public engagement is limited.

THE STEEL YARD PROVIDENCE, RHODE ISLAND / KLOPFER MARTIN

The re-introduction of steel-working at the Steel Yard is particularly relevant in the sense that it brings an industrial process back to a site that was shaped by its former incarnation. However, this programmatic element is only tied to the site historically, not in a way that symbiotically utilizes the waste by-products of other industries located nearby. Furthermore, while the project has succeeded very well in bringing new life to what had been a dilapidated and contaminated site, it remains a single, small project that operates independently of most of its surrounding urban context.

ELEMENTS OF RELEVANCE + INSPIRATION

- Industrial/craft based programming.

- Located within a highly deindustrialized central city neighborhood.

ELEMENTS OF CRITICISM/INCONGRUITY

- Single, small, isolated site in post-industrial area.

- Public use limited.

LANDSCHAFTSPARK DUISBURG-NORD DUISBURG, GERMANY / LATZ + PARTNER

Past industrial processes and relics are memorialized and integrated into the design of Landschaftspark Duisburg-Nord but the program remains confined to recreational and performance activities. Because of its aged infrastructure that specifically relates to an industry that will not be returning to the Ruhr Valley, the implementation of a new, industrial program would not have made sense for this project without demolishing all of it (and even then a new, industrial program would still have not likely made much sense). However, as part of the larger IBA Emscher Park regional revitalization strategy, the project has succeeded very well in its efforts to help economically revive the area. Furthermore, its encouragement of public activity and engagement with the site's unique infrastructure is a relevant correlation to this thesis' intent to create a program that will allow the public to engage with a re-industrialized, symbiotic landscape.

ELEMENTS OF RELEVANCE + INSPIRATION

- Comprehensive public use encouraged.

- Programmatic engagement with [obsolete] industrial infrastructure.

- Large scale economic stimulus—popular destination.

ELEMENTS OF CRITICISM/INCONGRUITY

- Single massive site in peripheral urban location (rather than urban core).

- Obsolete infrastructure and high contamination levels related to former reliance on non-renewable local resources makes re-industrialization impossible.

Bühne 6
57590

LOWELL NATIONAL HISTORICAL PARK LOWELL, MASSACHUSETTS

Lowell National Historical Park is relevant to this thesis because it was born of a strategy aimed at reviving the city's highly depressed urban core. It has succeeded in preserving the historic, industrial infrastructure. The city center as a whole now acts as a large museum, although it has not achieved the same sort of success as Landschaftspark Duisburg-Nord in terms of tourism. Of particular relevance to this thesis was the effort to introduce new industrial activity to Lowell in the 1980s in the form of minicomputer manufacturing. While not strictly a part of the National Historical Park project, the effort to "re-industrialize" worked hand in hand with the establishment of the NHP and the city's overall revitalization strategy. The reliance on this one industry (best exemplified by the single company of Wang Laboratories), recreated the cycle of boom and bust that the city had experienced previously through the rise and fall of textiles, albeit much quicker.

Lastly, while the existence of the NHP is a boon to Lowell, it requires ongoing federal funding and should be viewed as unique and special rather than as a model to emulate.

ELEMENTS OF RELEVANCE + INSPIRATION

- Comprehensive strategy incorporating urban core and encouragement of public use.
- Programmatic engagement with [obsolete] industrial infrastructure.

ELEMENTS OF CRITICISM/INCONGRUITY

- Anomaly rather than rule in NHP status.
- Vibrancy in city life still seems lacking.
- Re-industrialization collapsed due to reliance on single company within minicomputer manufacturing industry.

There are an additional 7 similar Heritage State Parks scattered throughout Massachusetts that have failed to achieve the same level of success as Lowell's.

15104 BRADDOCK, PENNSYLVANIA

The prospect of revival and hope contrasted against the backdrop of despair in the wake of deindustrialization makes the current efforts to revive Braddock, Pennsylvania a relevant precedent to this thesis. Having lost 90% of its population since the collapse of its industrial base, the town's future is now championed and branded as *15104* by Mayor John Fetterman who is working to transform the town's overwhelming abandonment into an asset.

The effort does not seek specifically to encourage renewed industrial activity but does seek to repopulate and refurbish abandoned buildings and vacant lots with new, innovative solutions, creating in effect a sort of test incubator for troubled post-industrial cities. One of the most relevant results has been the establishment of Fossil Free Fuel, a company that converts waste cooking oil to biofuel for vehicles, within the city. Other results have been the establishment of urban agriculture lots and a community center within the city on what had been abandoned land.

ELEMENTS OF RELEVANCE + INSPIRATION

- Innovative solutions to abandoned, post-industrial space including the establishment of a green energy production facility.

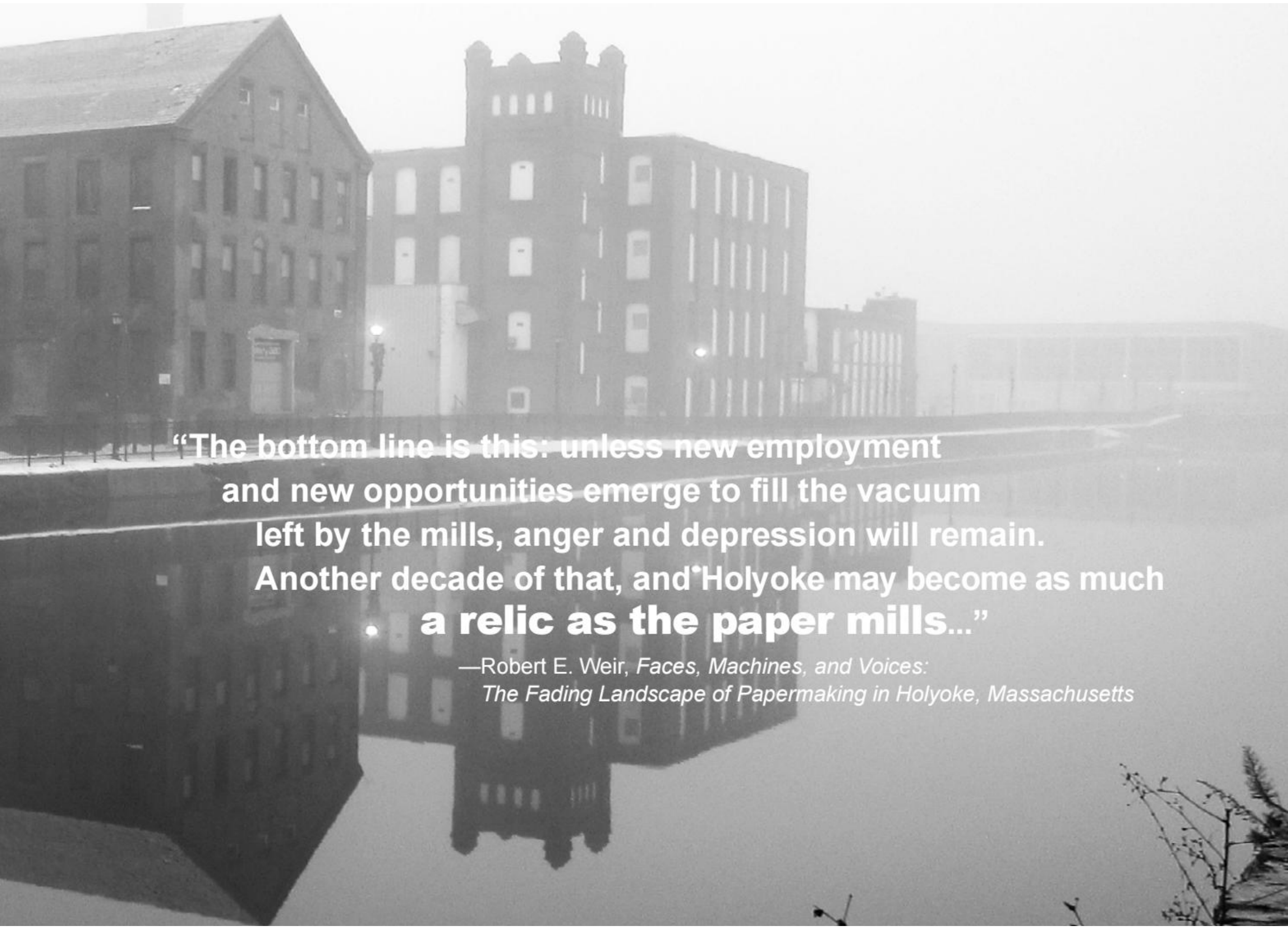
ELEMENTS OF CRITICISM/INCONGRUITY

- Vibrancy in the town is still lacking—Braddock still has a long way to go.

- Priority is placed on attracting artists and other creative people and fostering a stronger sense of community rather than on encouraging an increase in industrial or other business interests that would provide an influx of money and the beginnings of a stronger economic base.

- Primarily an economic strategy that does not particularly address issues of design or programmatic engagement with industrial infrastructure.

SITE + ANALYSIS



> “The bottom line is this: unless new employment and new opportunities emerge to fill the vacuum left by the mills, anger and depression will remain. Another decade of that, and Holyoke may become as much **a relic as the paper mills...**”
>
> —Robert E. Weir, *Faces, Machines, and Voices: The Fading Landscape of Papermaking in Holyoke, Massachusetts*

“During the past 25 years, **Holyoke’s manufacturing employment has decreased significantly**. This has resulted in an estimated 4.0 million square

feet of building area going vacant/idle and has impacted Center City considerably.”

—*Innovation-Based Economic Development Strategy for Holyoke and the Pioneer Valley*

HOLYOKE, MASSACHUSETTS

The city center of Holyoke, Massachusetts has been selected as the test site for this thesis. The most important criteria used in selecting it are:

- Its highly depressed and abandoned status due to widespread deindustrialization. Half of the residents of Holyoke Center City live in poverty while the district also contains 4 million square feet of vacant property.

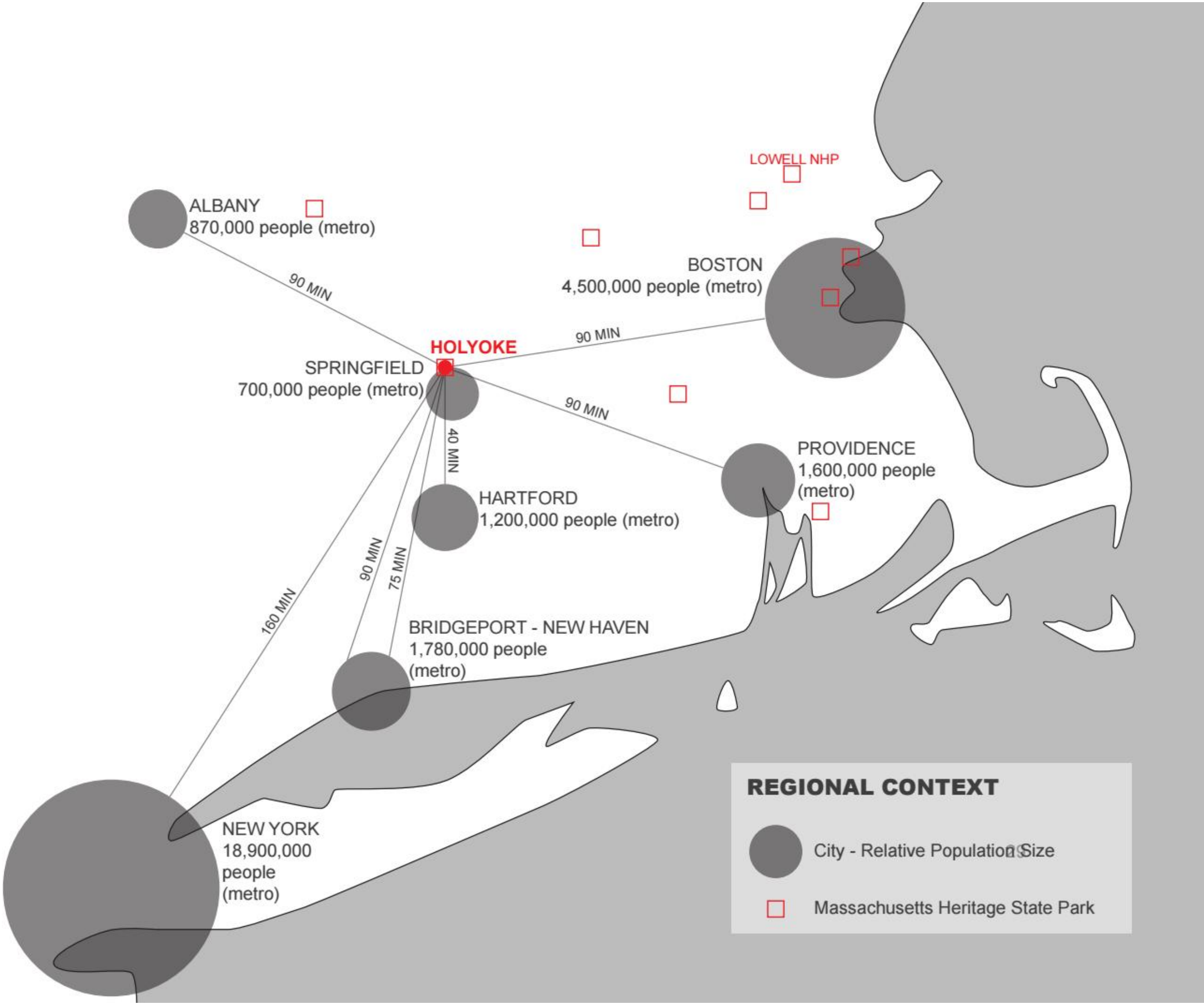
- Its industrial land (former and current) is tightly integrated into the downtown urban fabric. The industrial zone forms a nearly circular ring around residential and commercial districts, while itself being bounded by civic and commercial districts and the Connecticut River.

- Its industrial development occurred as a means to harness a renewable natural resource. Holyoke become a planned industrial city because of its location next to the substantial hydropower provided by a 60-foot drop in the Connecticut River at Hadley Falls.

- Its predominately pre-redevelopment status. With the exceptions of the Massachusetts Green High Performance Computing Center, Volleyball Hall of Fame/Children's Museum, and Heritage State Park, Holyoke's former industrial land and buildings remain abandoned.

- Its strategic location near major transportation arteries that lead to Boston, New York, and a host of other substantial albeit smaller cities.

- Its proximity to, and therefore likely inability to successfully compete with the tourism/historic preservation-based model of redevelopment. Anyone who might wish to visit a city for the purpose of experiencing it as an industrial-era living history museum will visit Lowell rather than Holyoke. The two cities are only an hour and a half apart from one another.


LOWELL NHP
ALBANY
870,000 people (metro)
BOSTON
4,500,000 people (metro)
90 MIN
HOLYOKE
90 MIN
SPRINGFIELD
700,000 people (metro)
90 MIN
40 MIN
PROVIDENCE
1,600,000 people
(metro)
HARTFORD
1,200,000 people (metro)
90 MIN
75 MIN
160 MIN
BRIDGEPORT - NEW HAVEN
1,780,000 people
(metro)
NEW YORK
18,900,000
people
(metro)
REGIONAL CONTEXT
City - Relative Population Size
Massachusetts Heritage State Park

HOLYOKE'S INDUSTRIAL HISTORY

Prior to its planned industrial development and renaming in 1850, the city of Holyoke had simply been known as Ireland Parish. From 1660 through the late 1700s this small community situated beside Hadley Falls' massive 60-foot drop in the Connecticut River remained predominately agrarian. The arrival of the Connecticut River Railroad and the initial, small-scale damming at the falls precipitated the large-scale changes that were to come.[2]

During the first half of the 19th century a group of wealthy investors successfully established the planned industrial communities of Lowell, Massachusetts, Manchester, New Hampshire, and Saco, Maine, among a host of others. Known as the Boston Associates, these investors turned their attentions towards Ireland Parish in the 1840s with the intention of harnessing the unprecedented power of Hadley Falls for the production of textiles (by comparison, Pawtucket Falls at Lowell drops only 32 feet—the drop at Hadley Falls is nearly double that). The result transformed idyllic Ireland Parish into a heavily constructed, heavily mechanized industrial landscape machine.

Despite the extent of the transformation and the immense waterpower available, the effort failed to attract the business base necessary to financially succeed and in 1859 the Boston Associates withdrew entirely from the project. Losing most of their invested capital, Holyoke became their final endeavor.[3]

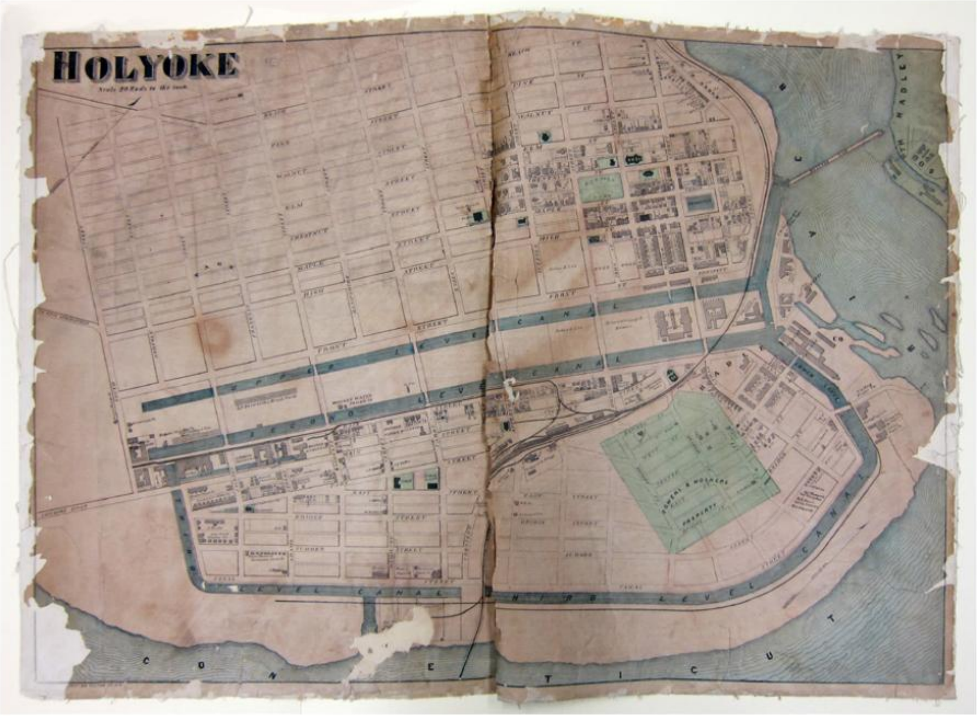
Because of this faltering start, Holyoke's urban development adopted a different character than those of its contemporaneous New England mill cities. The 1860s and 1870s were kinder to the city than the 1850s and the designated mill sites were gradually developed into productive factories, but these did not consist of the typical series of massive textile mills arrayed in a highly structured manner like elsewhere. Instead, Holyoke became more of a hodge-podge of textile and paper mills, as well as other manufacturing facilities. The predominance of the paper mills lent Holyoke its nickname, "The Paper City."

Though best known for its paper manufacturing, Holyoke's success relied equally on its textile mills. In the city's early days, these two facets of industry worked in symbiosis with one another: cotton rag produced by the textile mills was used by the paper mills to manufacture cotton-based paper. This system worked well until technological developments occurred in the 1920s that made wood-pulp based paper more cost-effective to produce. With the departure of New England's textile industry around this same time, Holyoke's paper manufacturers found themselves at a competitive disadvantage. The city was not infrastructurally well-equipped to produce wood-pulp based paper, and this industrial base began a long decline while new competitors in Maine and the northern midwest flourished.[4]

The decline hit its lowest point in the 1980s when the majority of Holyoke's remaining paper mills officially closed their doors. The period of hardship that followed has severely affected the city, particularly in and around its industrial center, with many buildings becoming abandoned and deteriorated. The city has also suffered and continues to suffer from high instances of poverty, unemployment, and crime.

Despite the significant downturn in the city's fortunes in recent decades, a number of industrial sites remain active, most notably those pertaining to the paper converting industry (which involves the re-processing of pre-manufactured paper rolls into other forms such as packaging; coatings are also frequently applied to the final product).

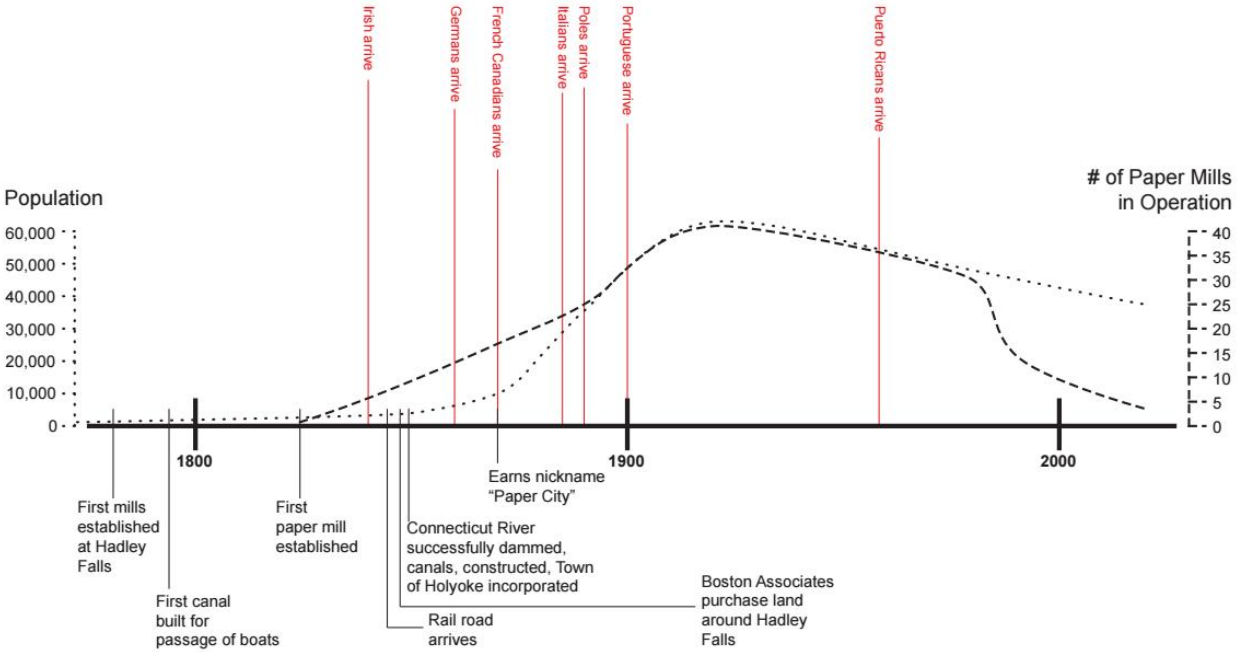
The massive water power of Hadley Falls is no longer used to power mill machinery but is instead harnessed by hydroelectric generators. The largest is located beside the dam itself, while other, smaller generators are scattered throughout Center City along the canal raceways. Even so, many of the raceways have been sealed since the city's industrial heyday, and the potential for further hydroelectric generation remains untapped.



1870 Map of Holyoke shows how the city's industrial development began in the northeastern and southwestern portions of Center City and grew inward.

Courtesy of the Holyoke History Room of the Holyoke Public Library.

HISTORIC TIMELINE + DEMOGRAPHIC TRENDS



CURRENT STATISTICS

Holyoke's industrial decline has not only resulted in an abundance of abandoned, contaminated properties, but also in a severe decline in quality of life for its residents. Service jobs at the Holyoke Ingleside Mall now constitute a more substantial segment of the workforce than do industrial jobs. The disparity in monetary earnings between the two types of work is striking.

27% of the population in Holyoke lives in poverty.
That number increases to 50% in Center City.

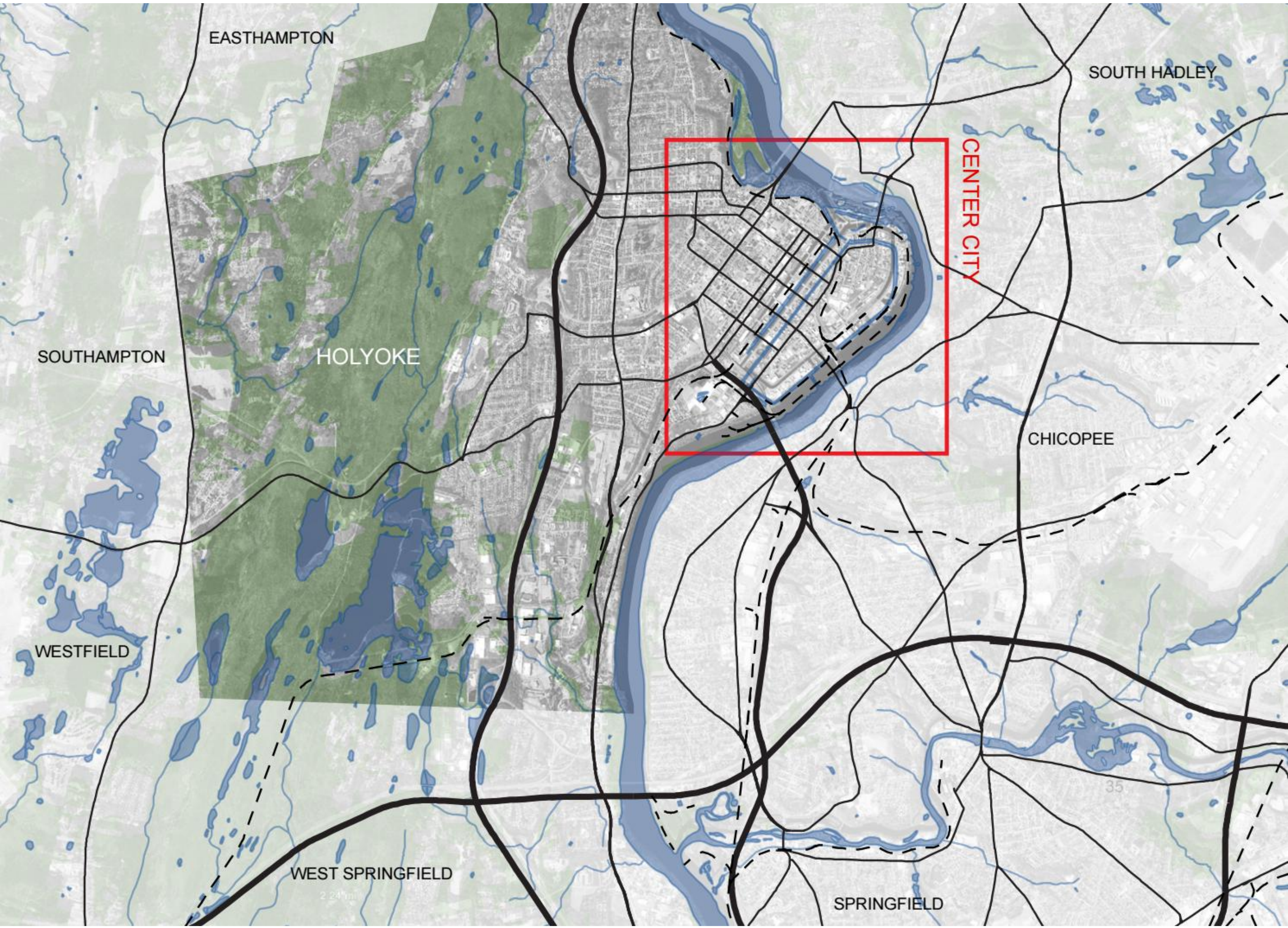
Holyoke population in 2009 was 39,549
Median age: 35
Median household income: $37,850

Center City population in 2009 was 10,723
Median age: 25
Median household income: $15,970

A COMPARISION OF HOLYOKE'S AVERAGE WAGES PER WEEK IN 2008
AMONG TOP INDUSTRIAL JOBS AND TOP SERVICE JOBS

Industrial Jobs		*Service/Retail Jobs*	
Construction	$1,041	Administrative Roles	$515
Manufacturing	$911	Retail	$389
Transportation/Warehousing	$628	Accommodation/Food Service	$281

Baseline Economic Conditions and Market Characteristics: The Center City Urban Renewal District, Holyoke, MA, Prepared for Vanasse Hangen Brustlin, Inc. Prepared by RKG Associates, October 2010.


EASTHAMPTON
SOUTH HADLEY
CENTER CITY
SOUTHAMPTON
HOLYOKE
CHICOPEE
WESTFIELD
35
WEST SPRINGFIELD
2.24 mi
SPRINGFIELD

OTHER CONTEXTUAL RESOURCES

Its location beside the Connecticut River just north of Springfield means that Holyoke is situated within the "Knowledge Corridor"—a region that extends from the Springfield area to Hartford, Connecticut and its surrounding towns. A flurry of activity is currently underway in this region as local and state governments and other collaborators work to develop solutions intended to help kick-start some of the suffering local economies and bring environmentally-friendlier solutions to pre-existing infrastructure.

Regional/municipal assets of particular relevance to this thesis include the following:

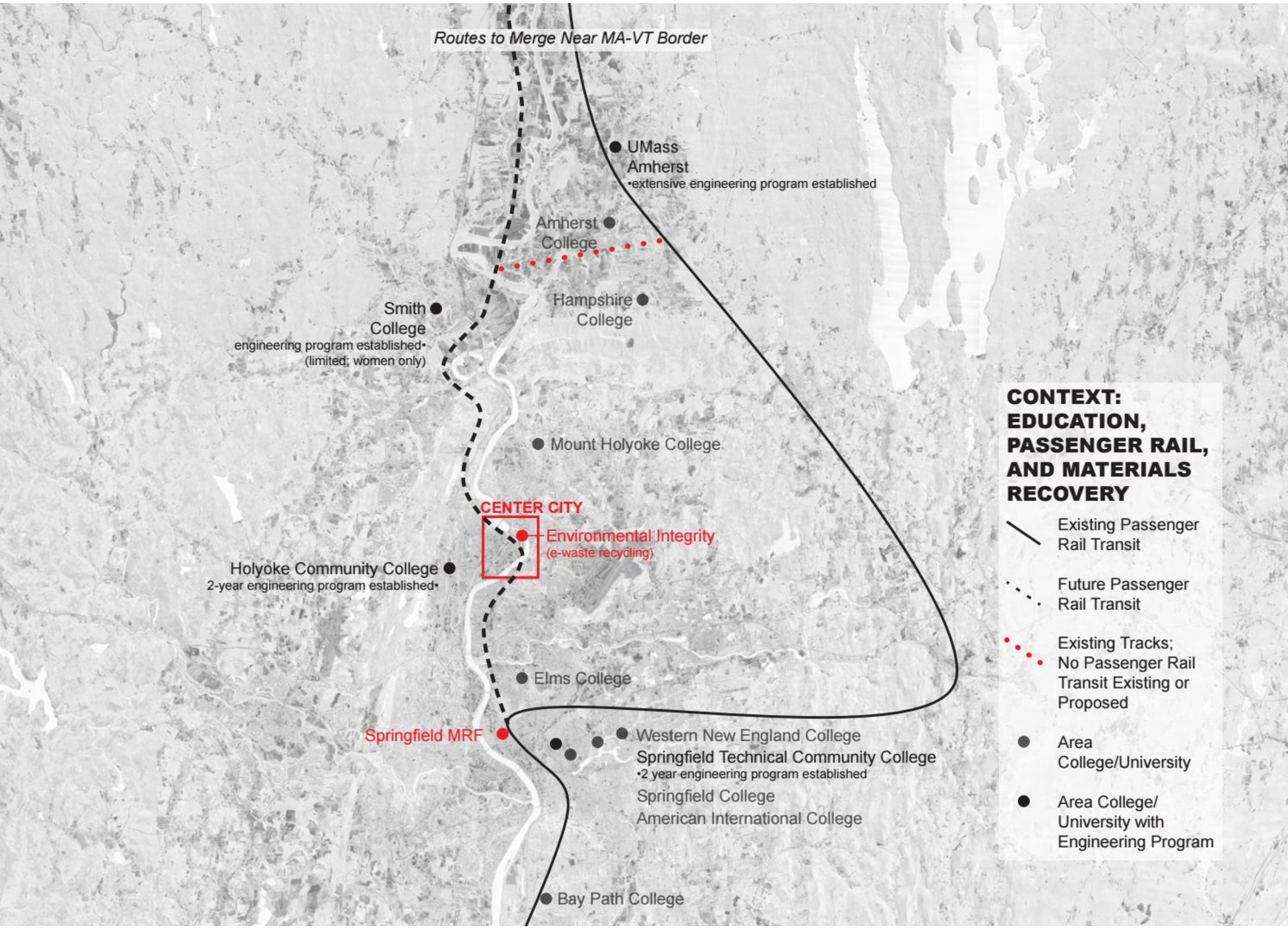
- The recent establishment of the Massachusetts Green High Performance Computing Center in central Holyoke. This is a clean energy powered data computation and research center that opened in late 2012. It is funded by a consortium of Massachusetts universities, private companies, and the state government.

- The reopening of Amtrak passenger service through Holyoke planned for 2014; platform to be located in Center City.

- The Springfield Materials Recycling Facility located adjacent to existing rail tracks in Springfield. This facility serves the majority of western Massachusetts as the primary collection point for further redistribution of recycleable materials.

- The existing 12 universities, liberal arts colleges, and community colleges within a 10 mile radius of Holyoke. UMass-Amherst is of particular note for its engineering department that focuses on clean energy in general and biofuel in particular as 2 of its core research interests.

- An existing e-waste recycling company located in Holyoke Center City.



CONTEXT: EDUCATION, PASSENGER RAIL, AND MATERIALS RECOVERY

Routes to Merge Near MA-VT Border
UMass Amherst
•extensive engineering program established
Amherst College
Hampshire College
Smith College
engineering program established•
(limited; women only)
Mount Holyoke College
CENTER CITY
Environmental Integrity
(e-waste recycling)
Holyoke Community College
2-year engineering program established•
Elms College
Springfield MRF
Western New England College
Springfield Technical Community College
•2 year engineering program established
Springfield College
American International College
Bay Path College
Existing Passenger Rail Transit
Future Passenger Rail Transit
Existing Tracks; No Passenger Rail Transit Existing or Proposed
Area College/University
Area College/ University with Engineering Program

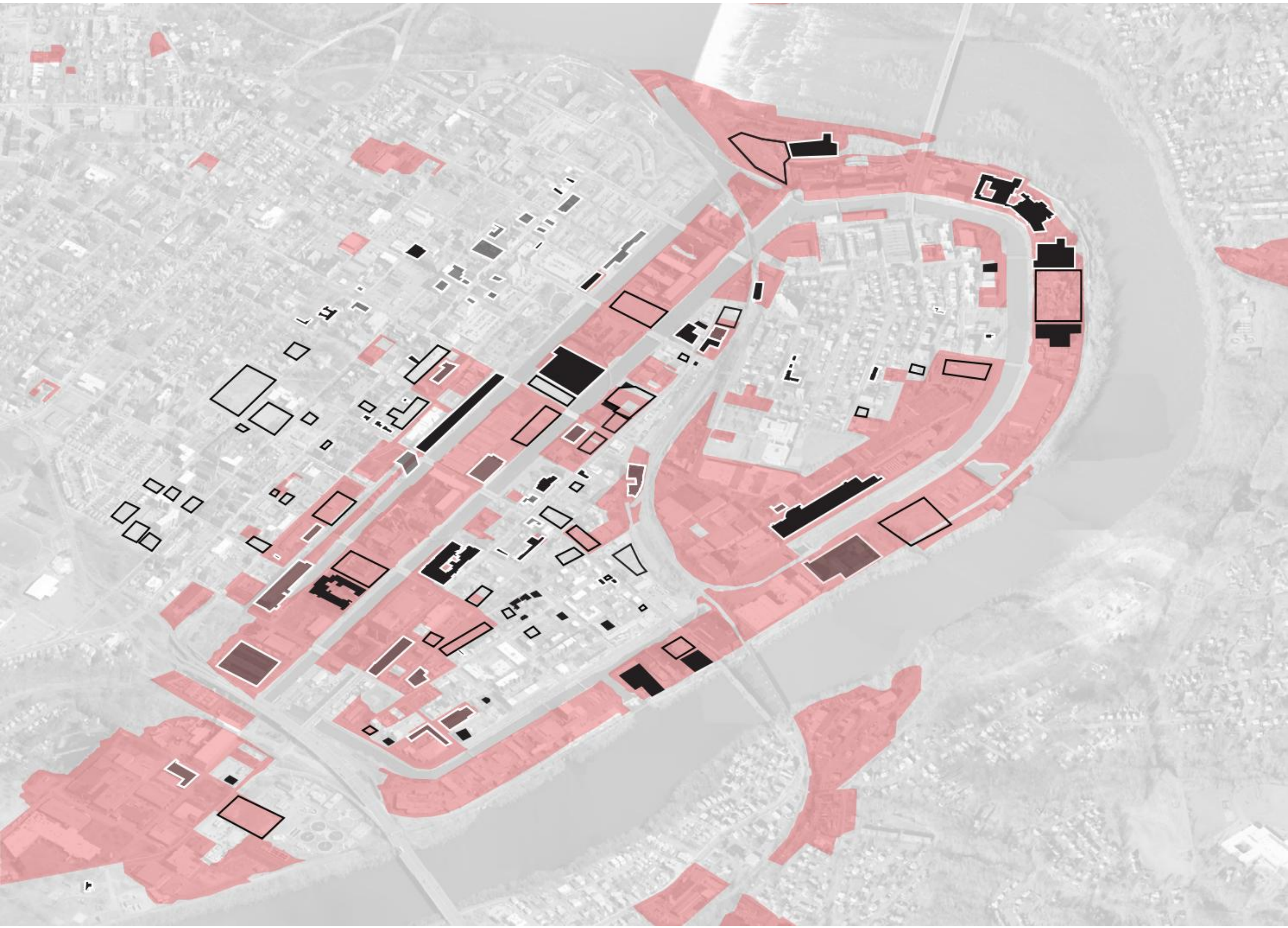
ABANDONMENT AND VACANT LAND

There is approximately 4.0 million square feet of vacant space in Holyoke Center City. The character of these spaces varies from empty lots to partially abandoned buildings to completely abandoned buildings while the qualities of these buildings themselves also range the gamut from salvageable to decayed beyond repair. Most of the larger spaces are located in land designated for industrial use.

Data derived from *MassGIS*, *Baseline Economic Conditions and Market Characteristics: The Center City Urban Renewal District*, and personal site visit observations.

- ▭ Vacant Lot
- ■ Fully Vacant Building in Poor Condition
- ▣ Fully Vacant Building in Salvageable Condition
- ▨ Partially Vacant Building; Salvageable Condition
- 🟥 Land Zoned for Industrial Use

There are ~76 RISD Bayard Ewing Buildings worth of vacant building space in Holyoke Center City.



ACTIVE INDUSTRIAL SITES

Despite the staggering proliferation of deindustrialization and abandonment, a number of industrial businesses have remained active in Center City. The most substantial segment is that belonging to the paper conversion industry. Other industrial businesses of note are those relating to biofuel manufacture and materials recycling.

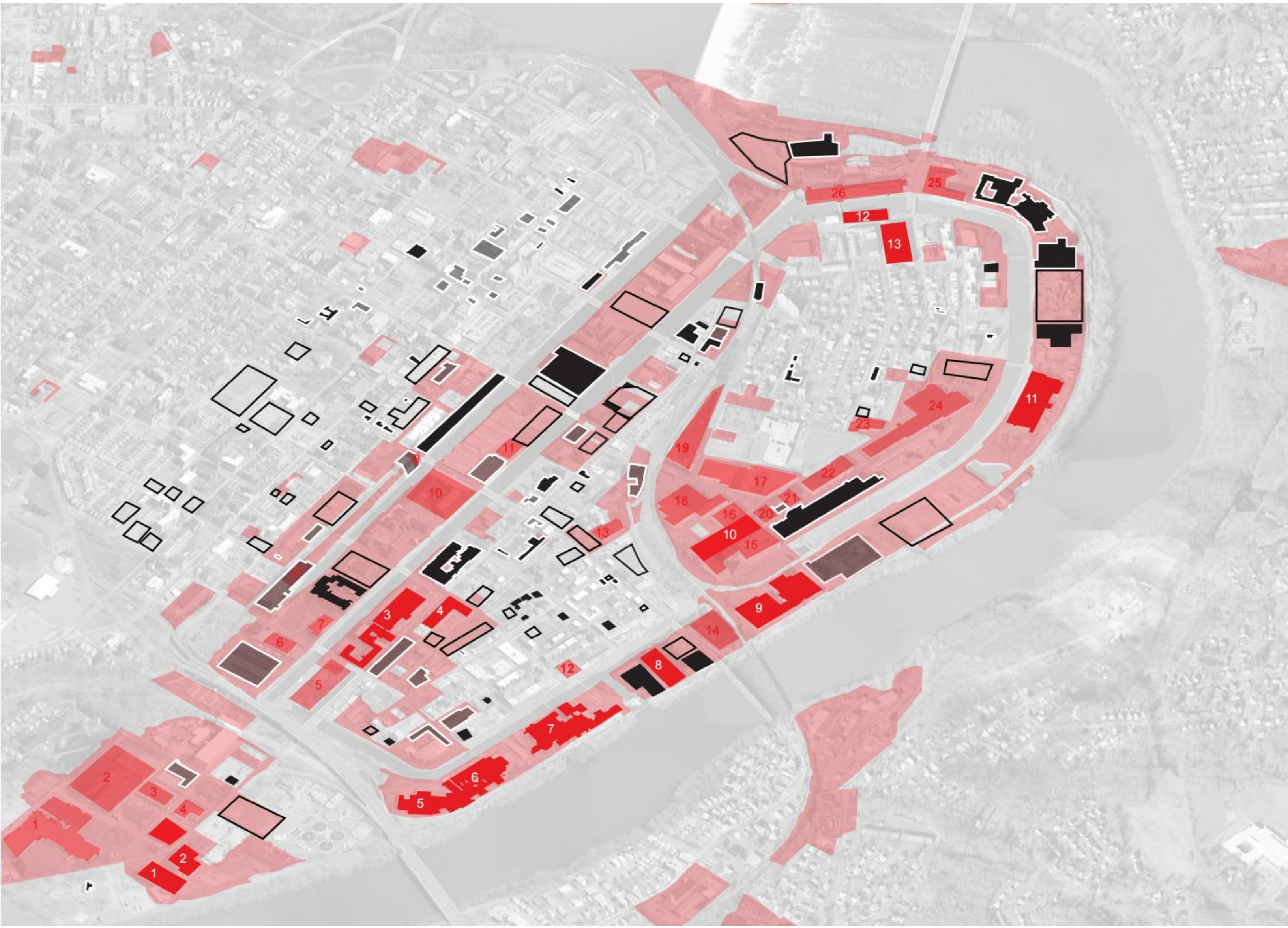
Data derived from *MassGIS*, *personal site visit observations*, and *online research*.

ACTIVE SITES RELATED TO THE PAPER INDUSTRY

1 - Printing (Marcus Printing)
2 - Printing (Hitchcock Press)
3 - Conversion (University Products)
4 - Industry Machines + Repair (Holyoke Machine Company)
5 - Conversion (Hazen)
6 - Conversion (University Products)
7 - Conversion (Sonoco)
8 - Conversion (United Paper Box Company)
9 - Conversion (Hamden)
10 - Conversion (AM Packaging)
11 - Conversion (Sonoco)
12 - Printing (Hadley Printing)
13 - Holyoke Public Works: Recycling Collection Center

OTHER ACTIVE INDUSTRIAL SITES

1 - Auto Transmission Components Manufacturer (US Tsubaki)
2 - Whole Sale Distribution (New Ade)
3 - Auto Cleaning Chemicals Manufacturer (C.A.R. Products)
4 - Finishing Service (New England Finishing)
5 - Mechanic Service (TWG Autos)
6 - Metal Supply Service (Sullivan Metals)
7 - Cogeneration Unit Manufacturer (Aegis Energy)
8 - PVC Millwork Service (Neu Tradition)
9 - Brewery (Paper City Brewery)
10 - Thermoformed Plastic Packaging Manufacturer (Walter Drake)
11 - Industrial Water Filter Manufacturer (Diamond Water Systems)
12 - Biofuel Facility (Dennis K. Burke, Inc.)
13 - Machining Service (Central Massachusetts Machine)
14 - *Undetermined* (Eastern Specialties)
15 - Vinyl Fabrication (NTP Republic) + Electronics Distribution (C&D Electronics)
16 - Petrified Wood Processing (Russell-Zuhl)
17 - Furniture Manufacturing (Conklin)
18 - Game/Puzzle Manufacturing (Edaron)
19 - Scrap Metal (Sullivan Metals)
20 - Sanitization Chemical Manufacturing (Creative Chemicals)
21 - Machining Service (Universal Quality Machine) + Woodworking (Eastern Mountain Woodworking)
22 - Vacuum Manufacturing (Ruwac)
23 - Finishing Service (West Side Finishing)
24 - Water Purification (Laurel Pure Water) + *Undetermined* (American Dream Modular Homes)
25 - Wire Recycling (Valley Wire) + **Electronic Recycling (Environmental Integrity)** + Elderly Care Home Services (WestMass ElderCare)
26 - Furniture Manufacturing (Conklin)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CONTAMINATION AND HAZARD

Because of its status as a former industrial center, Holyoke is full of brownfields. A substantial number of abandoned buildings and vacant lots have been designated with Activity Use Limitations by the Commonwealth of Massachusetts and some of the current sites of active industry handle a large quantity of toxic materials.

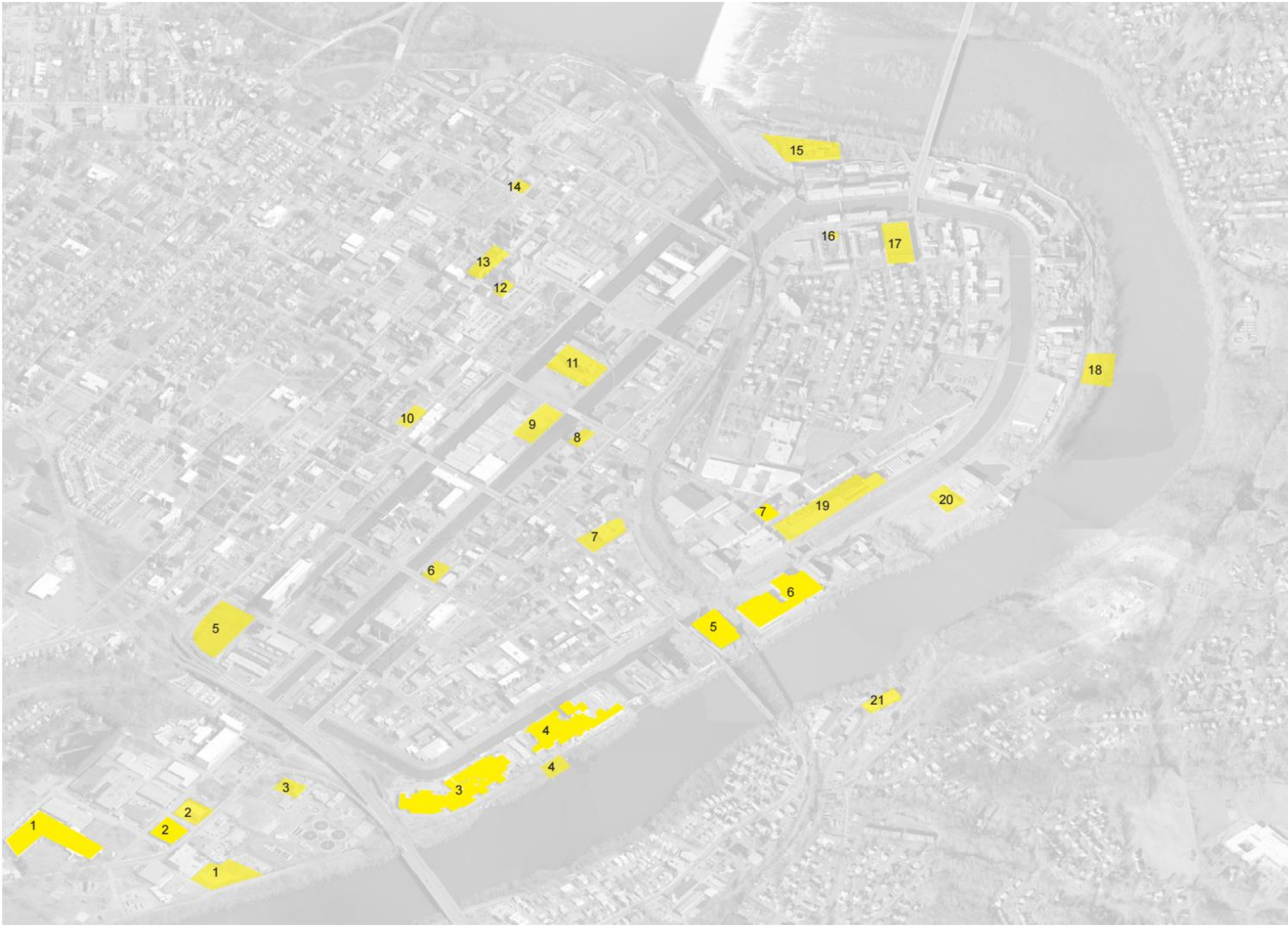
Data derived from *MassGIS*.

HIGH QUANTITY TOXIC MATERIAL USERS

1 - US Tsubaki
2 - Hazen
3 - Hazen
4 - Sonoco
5 - Eastern Specialties
6 - Hamden Paper
7 - Creative Chemicals

SITES WITH ACTIVITY USE LIMITATION IN EFFECT w/ HAZARDOUS MATERIAL IDENTIFIED

1 - Petroleum
2 - Chromium
3 - Holyoke Incinerator
4 - Aromatic and Aliphatic Hydrocarbons
5 - Petroleum of V.O.C.s
6 - Aromatic Hydrocarbons, Benzopyrene, Acenophthene, Benzoanthracene
7 - Lead, Chromium Zinc, EPH, VPH
8 - *Listed as High Quantity Hazardous Waste Handler (Dialectic Polymers) but appears now defunct*
9 - Petroleum; *Listed as High Quantity Hazardous Waste Handler (Mastex Industries) but appears now defunct*
10 - Oil
11 - Oil and V.O.C.s
12 - Oil
13 - Oil and Aliphatics
14 - Gasoline
15 - *Former gasworks*
16 - Undetermined
17 - Oil and Diesel
18 - *Gas Tar Deposits*
19 - Oil
20 - Lead, Antimony, Beryllium, Trichloroethene, TPH
21 - Oil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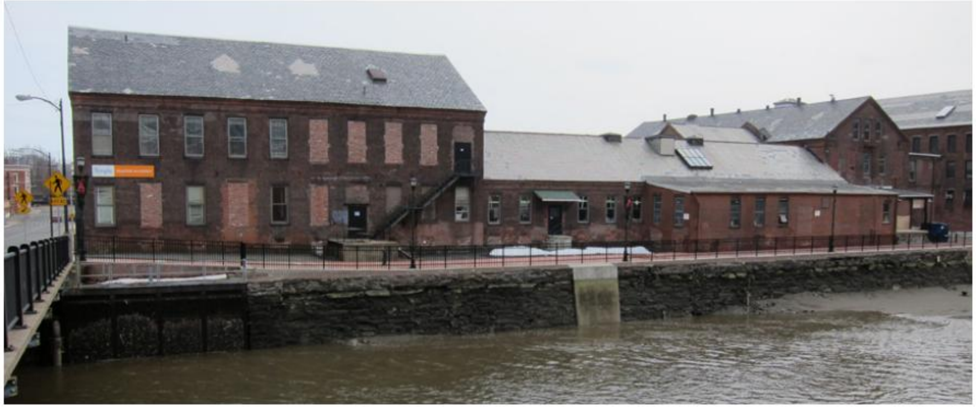
WATER AND HYDROELECTRICITY

Holyoke's canal system was constructed for the sole purpose of harnessing the natural power of Hadley Falls' 60-foot drop. To that end, the whole of Center City essentially became one giant landscape machine. However, over the course of the city's decline, a substantial number of the canal raceways that once fed water to the mill machinery have since been sealed or are in complete disrepair. The full potential of the city's hydroelectric capacity is therefore unrealized. Despite extensive human effort to control the environment, natural phenomena remain untameable and much of the lower-level industrial and residential land in Holyoke exists within the Connecticut River's floodplain.

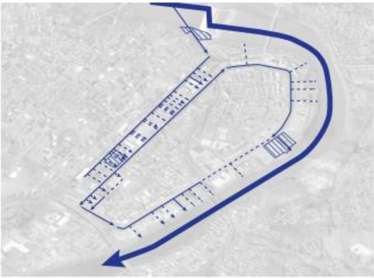
Images below and to the right depict former mill raceways that have been sealed with concrete. The photographs were taken along the 1st Level Canal on March 11, 2013 during a short period of time in which the water had been drained.

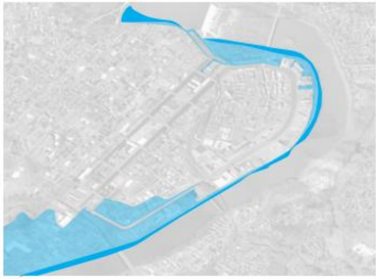


WATER AND HYDROELECTRICITY

The diagrams on this spread illustrate the active/inactive flows of water including their relation to the usage of land above the mill raceways, as well as the extent of the Connecticut River's floodplain.

Data derived from *MassGIS*, *Historical Documentation Report: The City of Holyoke*, and *personal site visit observations*.





▬ River Water Flow

— Active, Exposed/ Surface Canal/ Raceway Water Flow

- - - Active, Below Surface Canal/Raceway Water Flow

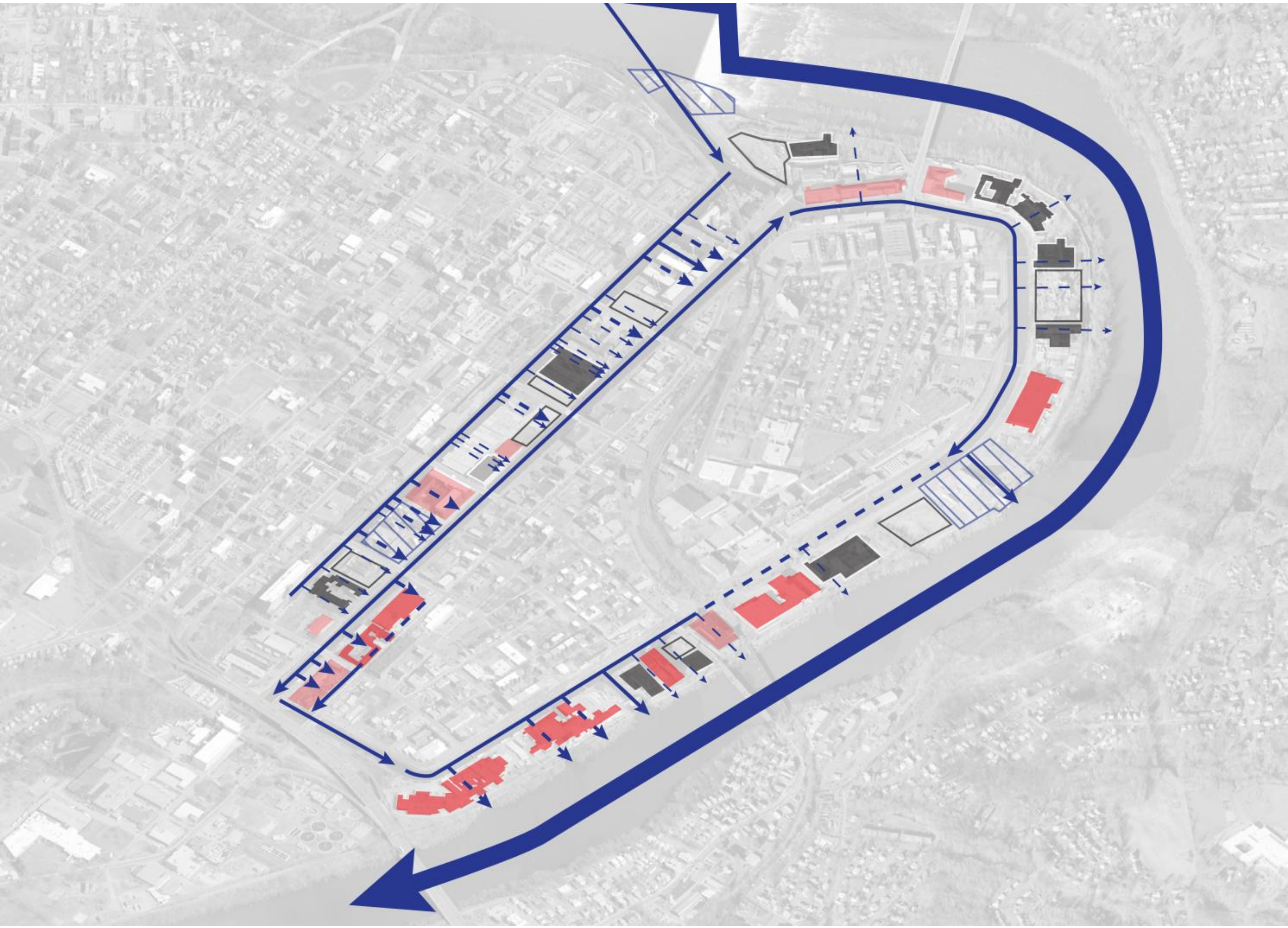
— Inactive, Exposed/ Surface Canal/ Raceway Water Flow

------ Inactive, Below Surface Canal/Raceway Water Flow

▨ Holyoke Gas & Electric Facility

▬ 100 Year Floodplain

▬ 500 Year Floodplain



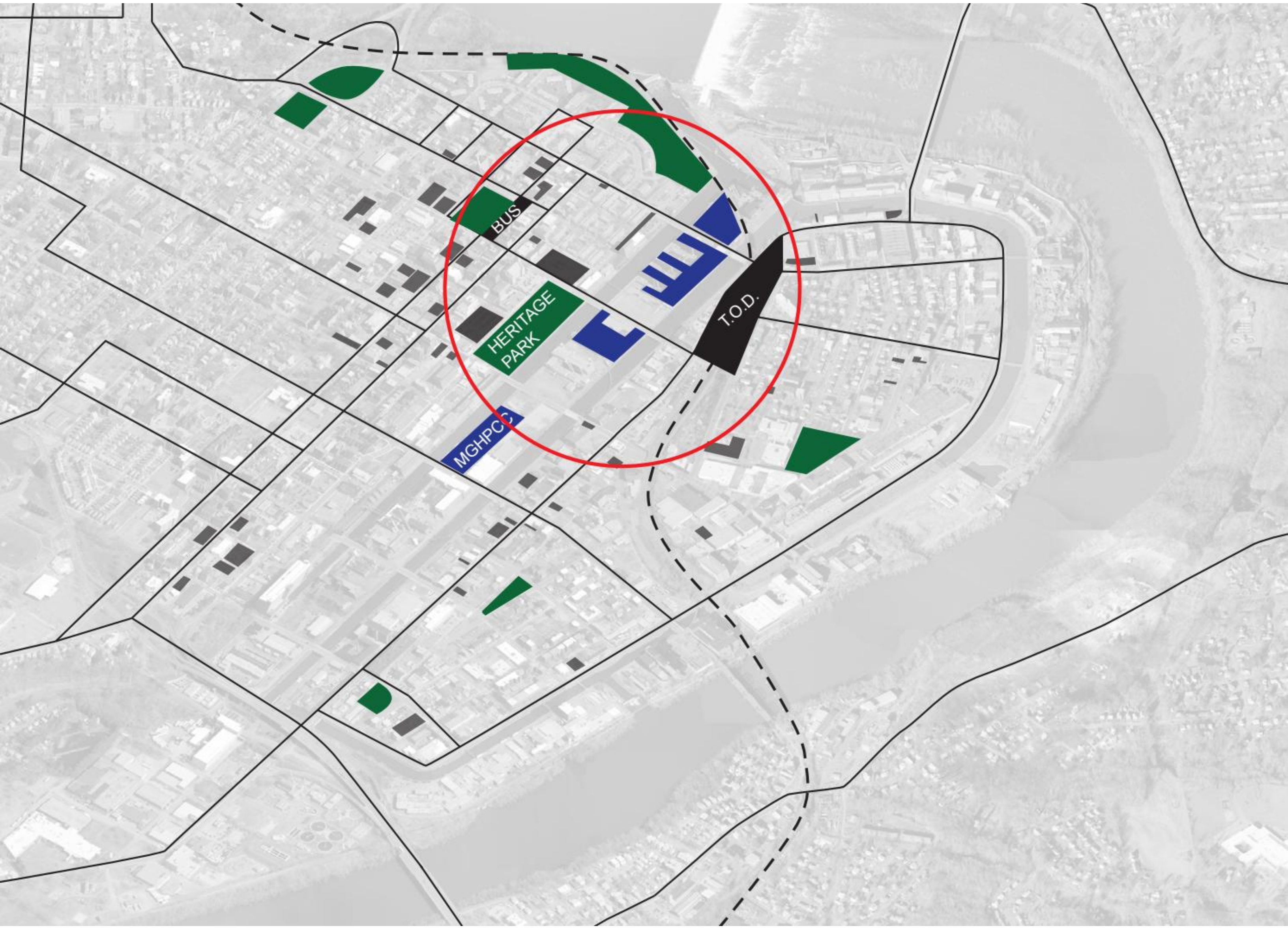
AHEAD
THE SLUICES ARE
SEALED AT THE

TRAFFIC FLOWS, PARKS, AND THE INNOVATION/ARTS DISTRICT

A new bus station was established in Center City in 2009 and a new Amtrak platform is planned to open in 2014. The location of these two developments (as well as the concentration of parking spaces) straddle the northern portions of the 1st and 2nd Level Canals. This area will become the hub of commuting to and from the city and is strategically located adjacently to the city's intended arts/innovation district (which is already home to the Massachusetts Green High Performance Computing Center), several existing green spaces, and is within easy walking distance to much of the industrial land.

Data derived from *Pioneer Valley Transit Authority System Map*, *Baseline Economic Conditions and Market Characteristics: The Center City Urban Renewal District*, *MassGIS*, and *personal site visit observations*

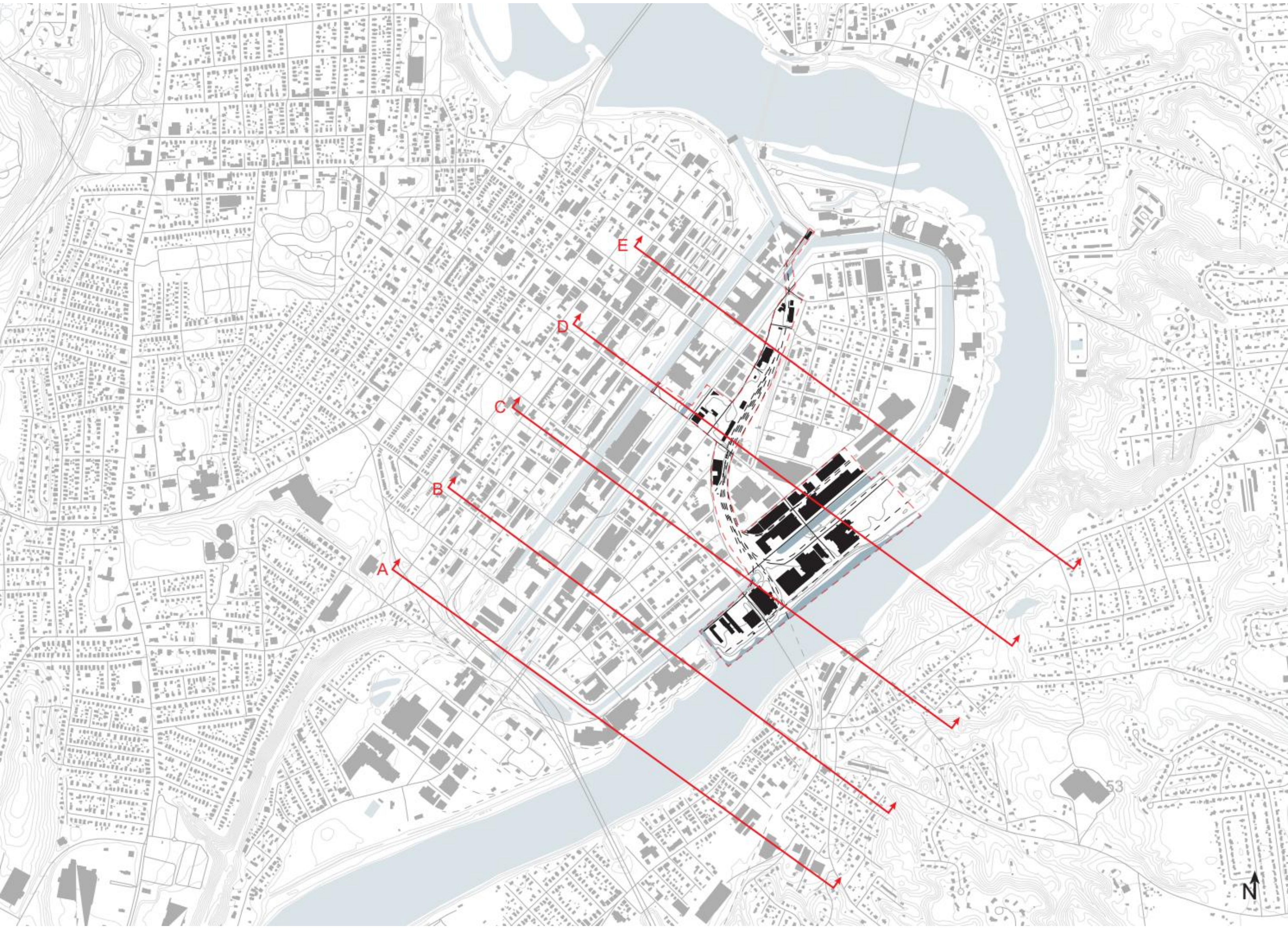
- - - -	Planned Passenger Rail
—	Bus Line
⬛	Parking Garages
▨	Parking Lots
🟩	Existing Park or Field
🟦	Existing Innovation/ Arts Space
○	Hub of Commuting


BUS
HERITAGE PARK
T.O.D.
MGHPCC

TOPOGRAPHY

The terrain of Holyoke slopes noticeably downward toward the river, which only makes sense when considering that it was this change in elevation that lead to its industrial development in the first place. The canals themselves were constructed to take full advantage of this natural condition. The elevation of the 1st Level Canal is 20 feet higher than that of the 2nd Level Canal—which mainly serves as a large-scale tailrace that receives water from the 1st Level and then directs it to the 3rd Level Canal. The 3rd Level itself varies in elevation but all sites situated along it exist at an elevation at least 30 feet above the average surface level of the river below.

The sections shown on the following pages illustrate the changes in topography that exist across 5 instances cut through central Holyoke and into neighboring Chicopee. The sections are exaggerated in the vertical dimension to better convey a sense of the relative topographic change and varying elevation of the canal system. They also illustrate active/inactive flow of water through the raceways as well as the relative mass of intersected buildings where they are cut.


E
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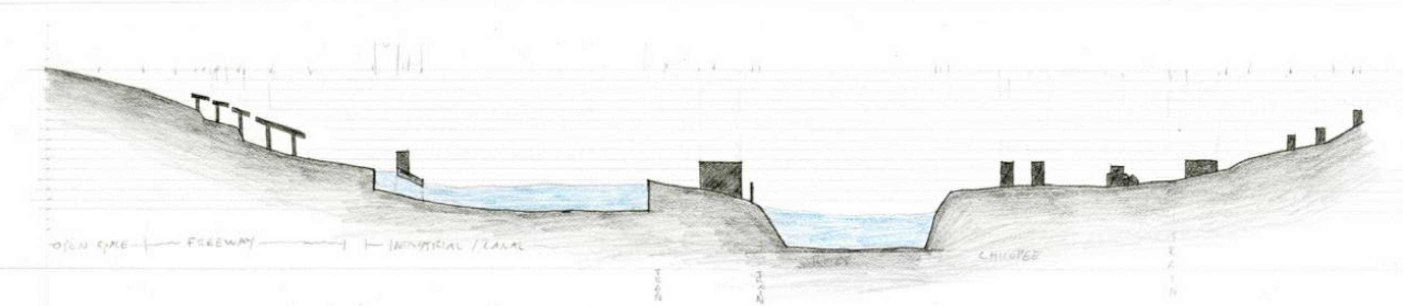
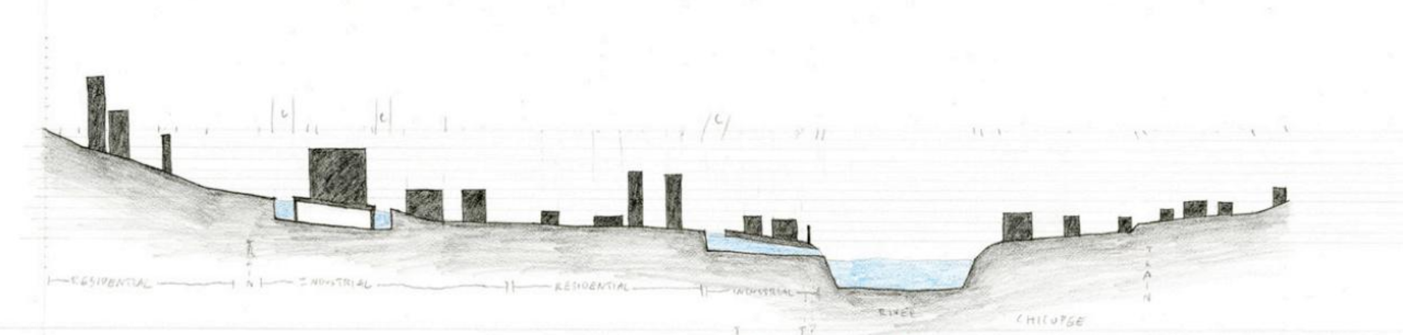
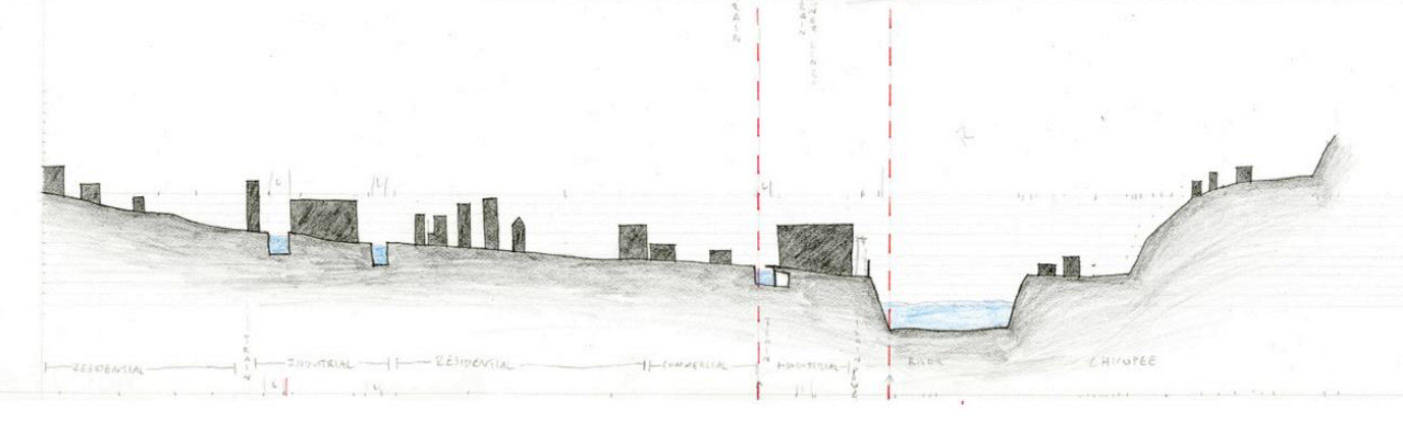
A

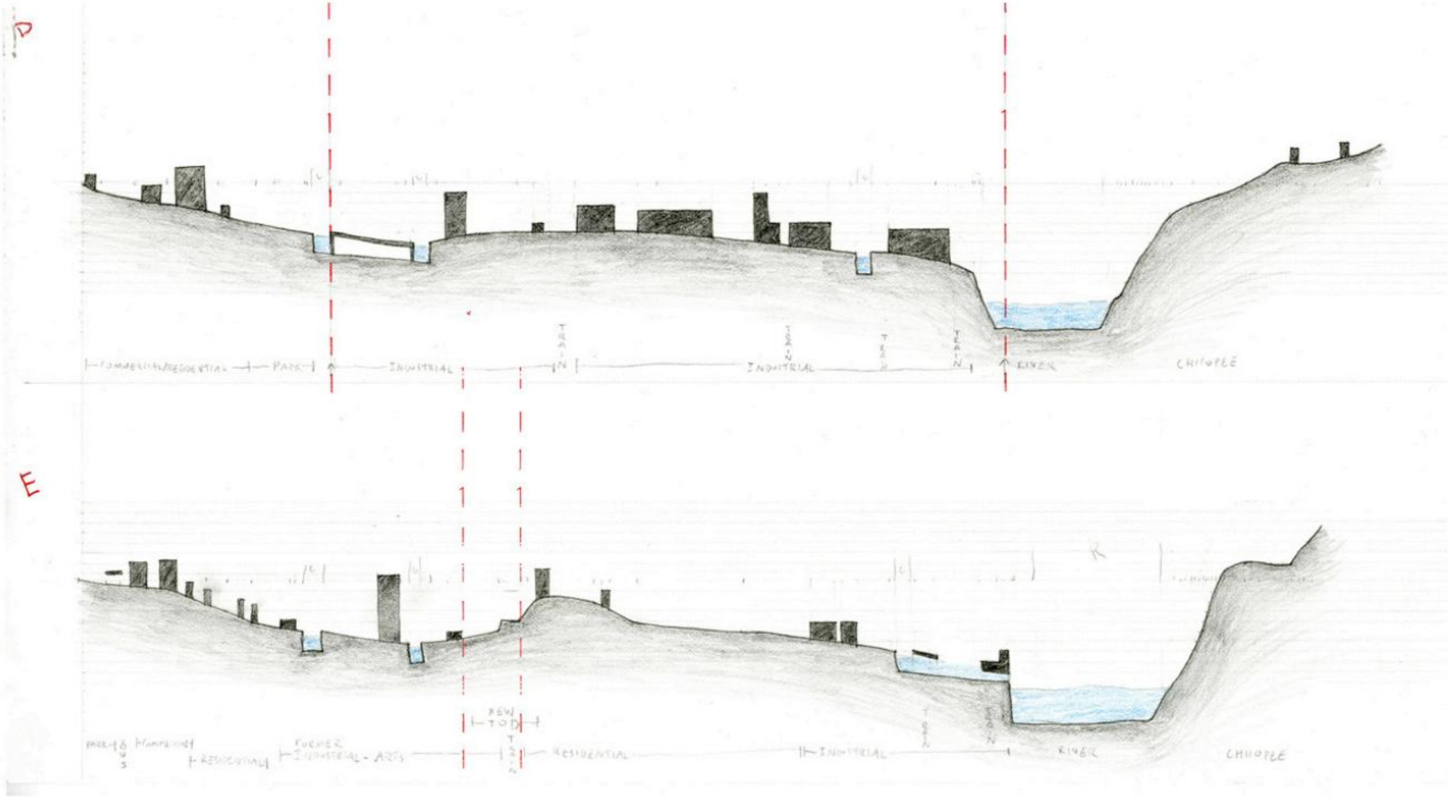

OPEN SPACE
FREEWAY
INDUSTRIAL / CANAL
TRAIN
TRAIN
RIVER
CHICOPEE
TRAIN

B

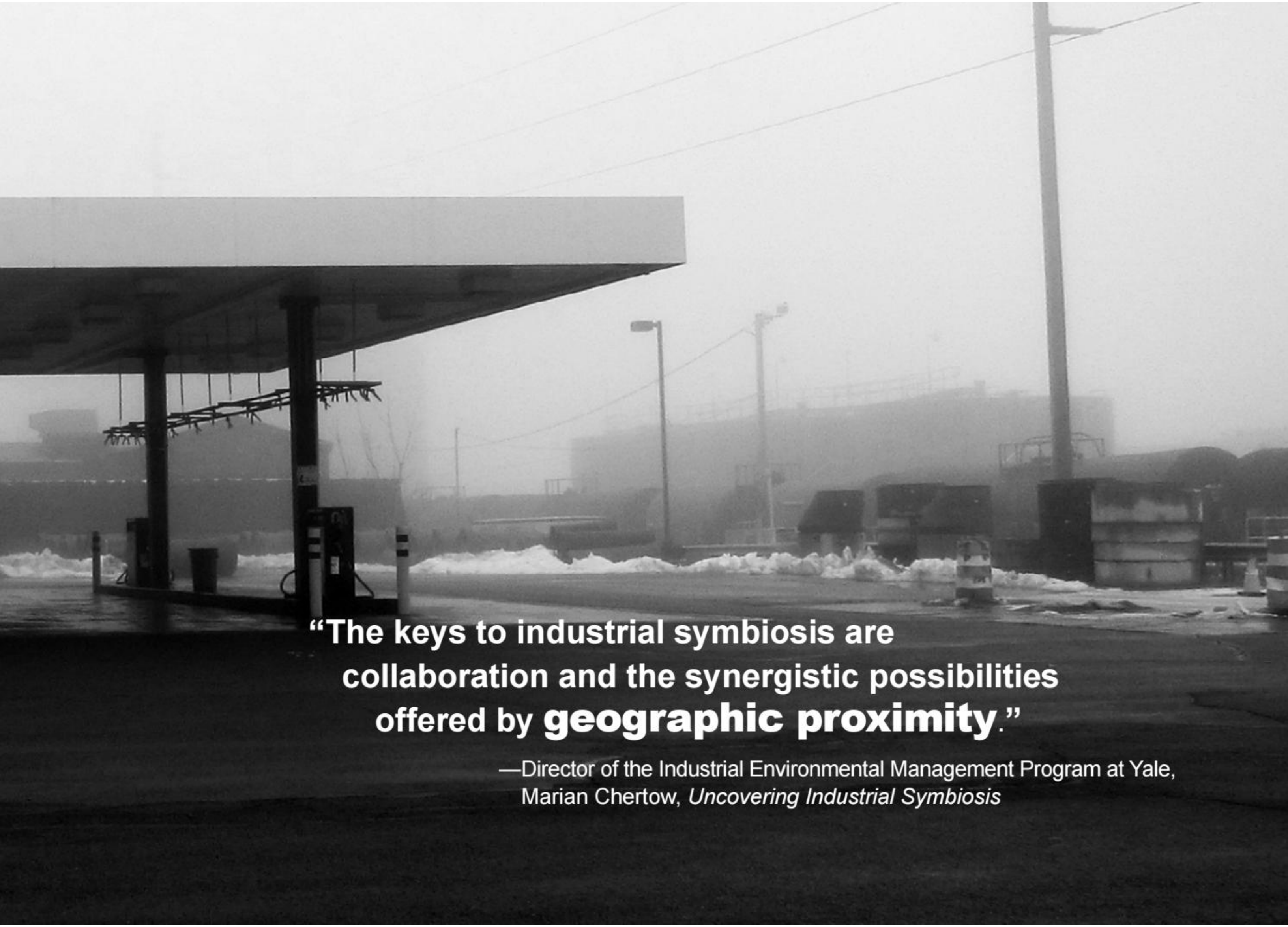

RESIDENTIAL
TRAIN
INDUSTRIAL
RESIDENTIAL
INDUSTRIAL
RIVER
CHICOPEE
TRAIN

C


TRAIN
TRAIN
POWER LINES
RESIDENTIAL
TRAIN
INDUSTRIAL
RESIDENTIAL
COMMERCIAL
TRAIN
INDUSTRIAL
TRAIN
POWE
RIVER
CHICOPEE


D
COMMERCIAL/RESIDENTIAL
PARK
INDUSTRIAL
TRAIN
INDUSTRIAL
TRAIN
TRAIN
TRAIN
RIVER
CHICOPEE
E
R
PARK
BUS
RESIDENTIAL
FORMER INDUSTRIAL - ARTS
NEW TOD
TRAIN
RESIDENTIAL
INDUSTRIAL
TRAIN
TRAIN
RIVER
CHICOPEE

PROGRAM



> “The keys to industrial symbiosis are collaboration and the synergistic possibilities offered by **geographic proximity**.”
>
> —Director of the Industrial Environmental Management Program at Yale,
> Marian Chertow, *Uncovering Industrial Symbiosis*

PROGRAM

The program is customized to Holyoke within the thesis' overarching framework and intention to provide a physical platform that both cultivates industrial symbiosis and encourages people to observe and engage with the reanimated infrastructural machine.

The primary crux of the landscape infrastructure that is intended to achieve this is the creation of a new Connective System. Relying heavily on improvements to the existing rail network, this system both encourages and allows for increased ease of flow, convenience, and cost-effectiveness in the exchange of goods among Holyoke's various active industrial players, as well as those of other nearby municipalities. Other factors that inform this aspect of the program and site design are proximity to the freeway network and the location of a preexisting biofuel facility in Holyoke Center City.

Working in conjunction with this Connective System is the suggestion of several, new industrial spaces that are related to those already found in the city. These spaces are meant to take advantage not only of the proposed Connective System, but also of Holyoke's other preexisting assets, and to further build upon them. The city's existing paper conversion and materials recycling industries become crucial, as does its close proximity to the Springfield Materials Recycling Facility.

As previously mentioned, one of the factors that becomes critical to the success of any industrial symbiosis is the ability for different industries organized under different owners to remain flexible and to retain a good degree of self-direction. To that effect, this thesis only suggests these new industrial spaces as good, relevant starting points. While the planning in the next section of this book takes them into account, it and the program both leave a substantial measure of vacant space vacant and suggests rezoning certain parts of Center City so that new, as-yet-unidentified-and-unestablished industries may eventually establish themselves within the network of the connective system.

Supporting these proposed industrial spaces are several suggestions for increased collaboration in the clean energy and arts/innovation realms, which fits well with the clean energy innovation objectives outlined in the *Innovation-Based Economic Development Strategy for Holyoke and the Pioneer Valley*.

Hydropower is an obvious starting point in this regard because Holyoke already derives approximately 2/3 of its energy from the natural, renewable power source of the Connecticut River. Recent years have also seen substantial efforts to increase local solar power. Because of this, Holyoke possesses great potential to become a city fully powered by clean energy. Combining this potential with the clean energy research interests of UMass - Amherst's engineering department and the computing power of Holyoke's own MGHPCC would yield a highly fruitful research and development collaborative in which Holyoke itself would become a full-scale, real-world living laboratory.

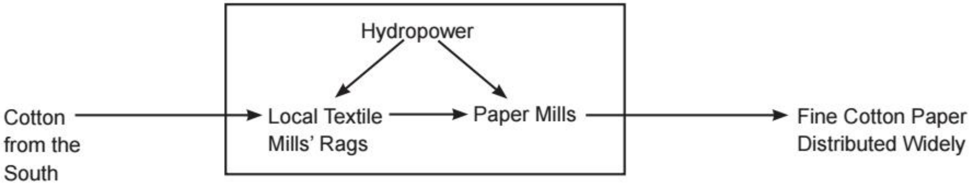
Finally, the program weaves an enhanced pedestrian/cyclist experience through all of the proposed industrial and research/development interventions. The rebirth of Center City as a clean-energy-powered 21st industrial landscape machine creates many significant opportunities for the public to observe and experience a very unique flow of goods and materials as well as the operation and generation of hydroelectric and solar power. The programmatic and design details of this public experience are informed by the strategic industrial and research/development planning initiatives so that the opportunities for recreation themselves become symbiotic with those for industry and heavy transportation.

REPROGRAMMING THE EXISTING INDUSTRIAL BASE

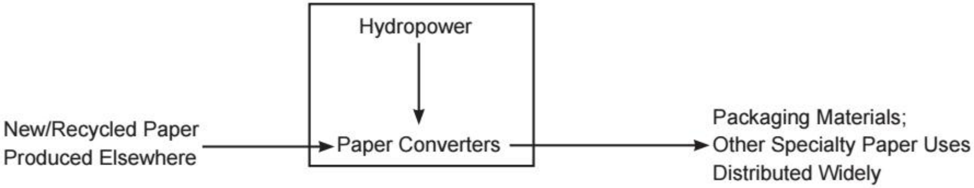
The diagrams on this spread illustrate the development of Holyoke's paper industry over time and its relationship to other industries within the city. Of particular note is the fact that the original paper manufacturing model of the city had operated in a sort of symbiosis with the former textile mills (although this model was an environmentally destructive form of symbiosis).

The proposal for a new model is based on the real existence of paper converters and local/regional clean energy and recycling initiatives.

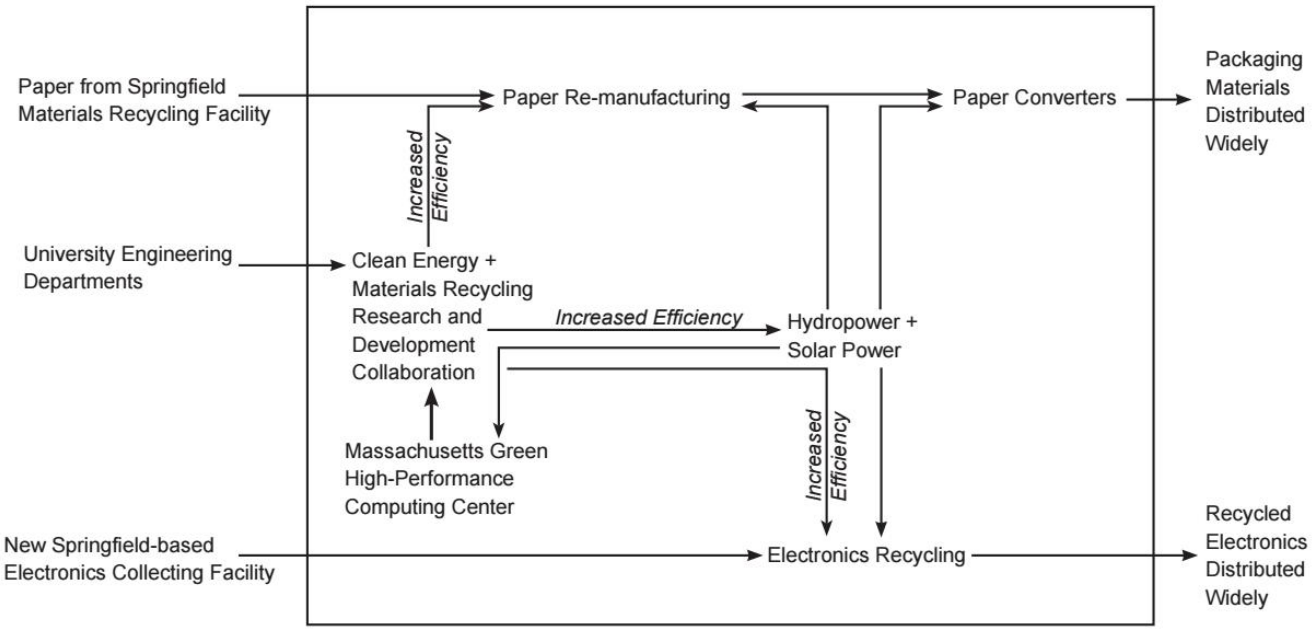
Holyoke's Historic Paper Manufacturing Model


Hydropower
Cotton from the South
Local Textile Mills' Rags
Paper Mills
Fine Cotton Paper Distributed Widely

Holyoke's Current Paper Converting Model


Hydropower
New/Recycled Paper Produced Elsewhere
Paper Converters
Packaging Materials; Other Specialty Paper Uses Distributed Widely

Suggestions for Realigning Holyoke's Industrial Base towards Symbiosis


Paper from Springfield Materials Recycling Facility
Paper Re-manufacturing
Paper Converters
Packaging Materials Distributed Widely
Increased Efficiency
University Engineering Departments
Clean Energy + Materials Recycling Research and Development Collaboration
Increased Efficiency
Hydropower + Solar Power
Massachusetts Green High-Performance Computing Center
Increased Efficiency
New Springfield-based Electronics Collecting Facility
Electronics Recycling
Recycled Electronics Distributed Widely

PROGRAMMATIC BULLETPOINTS

CONNECTIVE SYSTEM

The Connective System forms the backbone for Holyoke's potential symbiotic industrial growth. It allows and provides for an increased efficiency in the exchange of materials among the existing, crucial industrial anchors. Key components of the Connective System include:

- Modifications to/expansion of existing rail lines for clean-energy-supplied, inter-city collection and distribution.
- Modifications to/expansion of existing rail lines for clean-energy-supplied, Holyoke intra-city collection and distribution.
- Relocation/expansion of bio-gas facility for trucking distribution.
- Modifications to streets and riverfront for improved pedestrian/cyclist experience and access to new facilities and spaces.

SYMBIOTIC INDUSTRIAL NERVE CENTER

The clustering of paper and e-waste recycling and distribution facilities along the Connective System forms the Symbiotic Industrial Nerve Center. More specifically, it is comprised of:

THE PAPER TRAIL

The Paper Trail utilizes the Connective System to allow for an increased efficiency in the physical exchange of paper products between the Springfield MRF, Holyoke's related industrial sites, and the final destinations beyond the city's borders. Key components of the Paper Trail include:

- New recycling facility.
- Existing conversion and printing facilities.
- Existing equipment manufacturing and repair.
- The Springfield MRF.

THE E-WASTE TRAIL

Similar to the Paper Trail, the E-Waste trail utilizes the Connective System to allow for an increased efficiency in the physical exchange of electronic waste products between the Springfield MRF, Holyoke, and destinations beyond. The key components are:

- Expansion of existing wire and electronics recycling facilities.

- Expansion of the Springfield MRF to include e-waste collection and processing.

SHIPPING/DISTRIBUTION CENTER

The shipping and distribution center handles material produced by the recycling facilities that is not marked for immediate reuse within Holyoke. The center stores that material either for future use within Holyoke or until it is ready to be shipped via freight or truck far beyond Holyoke's boundaries. Its key functions include:

- Collection of relevant recycleables from Springfield Materials Recycling Facility and Holyoke Public Works facility via the Connective System.

- Sorting and distribution of relevant recycleables to appropriate recycling facility via Holyoke intra-city freight.

- Collection and distribution of recycled goods via freight or bio-gas fueled truck to destinations.

- Distribution of useful recycled goods via Holyoke intra-city Connective System for further processing before wider distribution.

CLEAN ENERGY PRODUCTION AND RESEARCH + DEVELOPMENT

Clean energy production and research and development programming, in conjunction with the programming of the Symbiotic Industrial Nerve Center, plays an important role in bringing new life to Holyoke. Energy generation itself is industrial in nature, and Holyoke and its surrounding context

PROGRAMMATIC BULLETPOINTS CONTINUED

feature many under-utilized clean energy assets that would complement the proposed recycling/manufacturing and materials exchanges very well.

Key components to the clean energy research and development aspects of the plan include:

- The reopening and reactivation of presently sealed canal raceways for the harnessing of additional, clean electricity.
- A new hydro-electric efficiency facility to serve as a test laboratory for clean energy (hydropower) research conducted by the UMass-Amherst engineering department.
- Office and class space to support and provide student access to the research and experiments conducted at the hydro-electric test facility. This space could expand to also include research in the field of materials reuse, thereby providing relevant support to the proposed recycling facilities.
- An in-house machine shop for the engineering program to use in the construction of test components for hydro/solar/etc. equipment.

RECREATING WITH THE MACHINE

The proposed Nerve Center and clean energy programming create many opportunities for unique, recreational human experiences. Those most ripe with potential to overlap industrial renewal with recreational experience are listed below.

INDUSTRIAL PEDESTRIAN/BICYCLE TRAIL

A network of pedestrian and cyclist friendly paths cut through and across the new and improved industrial infrastructure, allowing people to observe and experience the symbiotic renewal of Holyoke firsthand. Some of the highlights for increased interaction with the industrial activity include:

CONFLUENCE PARK

Proper grading and cut and fill around a particular segment of the Connective System creates a unique space intertwined with Holyoke's new infrastructure and renewed industrial activity.

- Rock-climbing wall.

- Rental and refreshment/snack space.

- Platform for viewing the Nerve Center.

- Expansive leisure space.

HYDRO-PARK + BEER GARDEN

A reopened millrace in a central location not only provides an interesting backdrop to a new park amenity, but also highlights the functionality of hydropower to the general public.

- Reactivated millrace with hydro-electric generator.

- Beer garden operating in conjunction with Paper City Brewing Company.

- Lawn with ample space for summer concert performances.

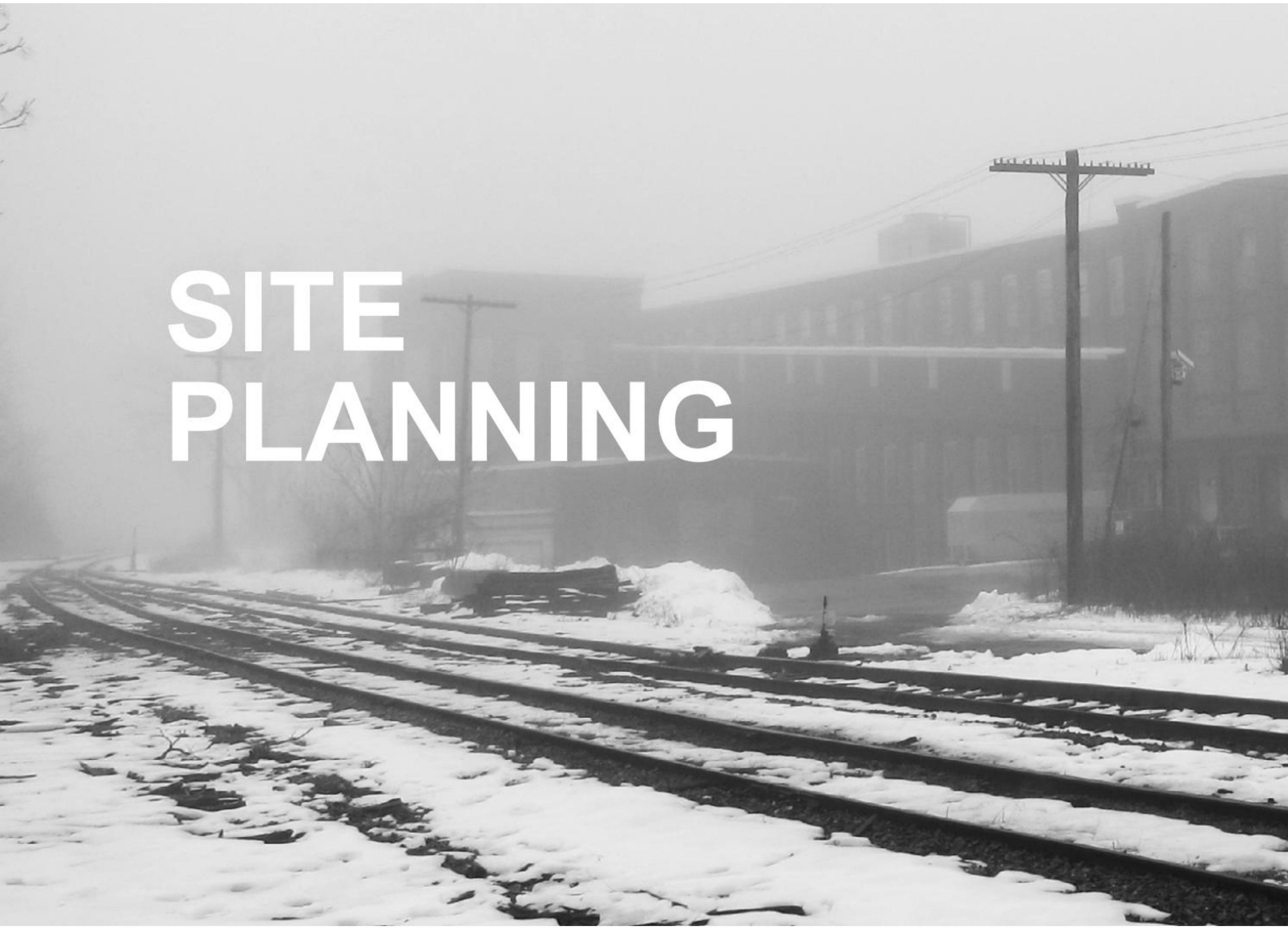
SOLAR SKATE PARK

Solar panels relate well to the mission for increased clean energy production and are best served in areas where canopy will not obstruct direct sunlight. Constructed atop large plinths, they not only provide shading to users of the site but also become a beacon of the program's clean energy message.

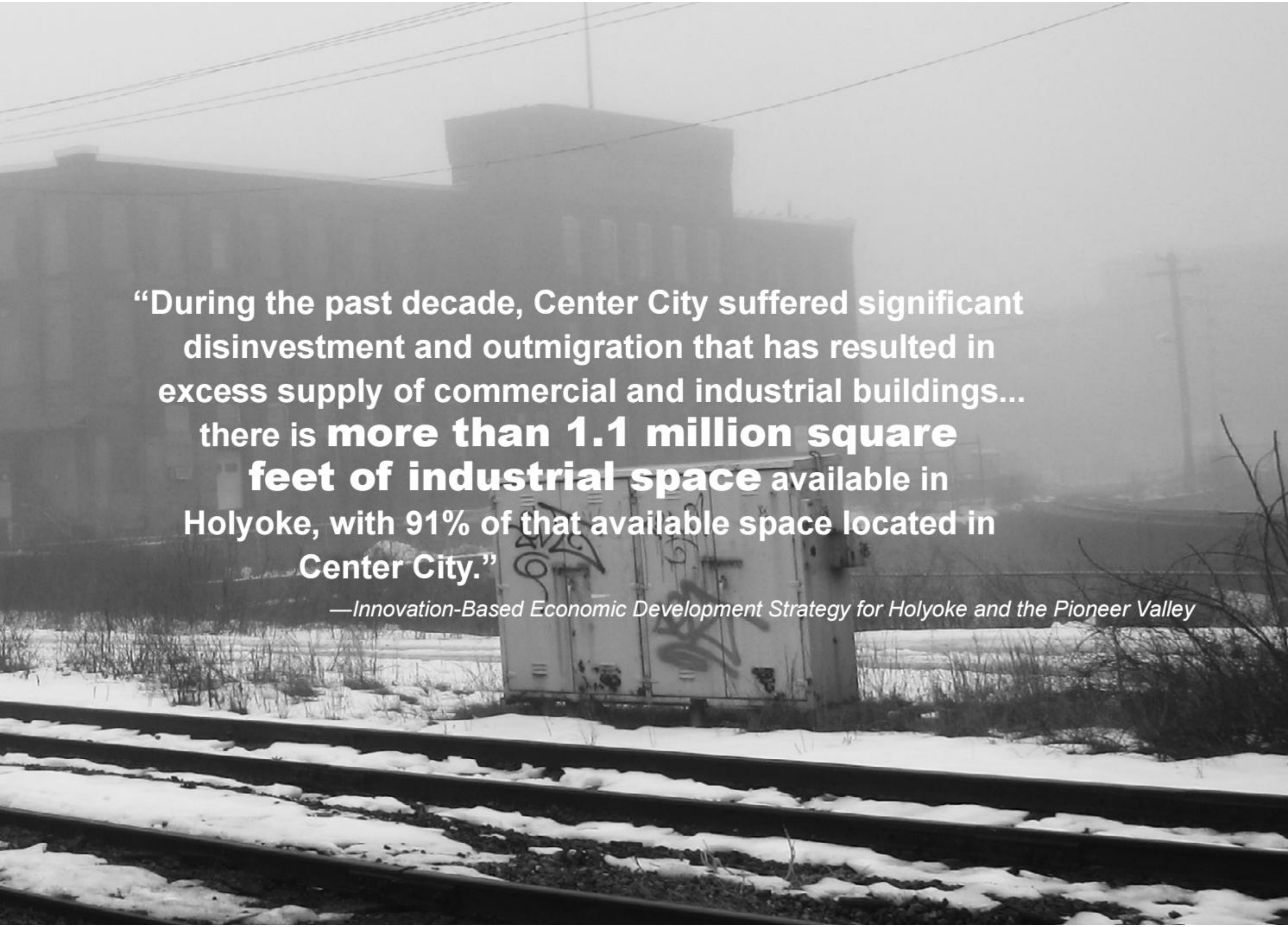
- Skateboarding space with protected solar panels.

INDUSTRIAL RUINS PARK

While not central to the reindustrialization goals of this thesis, this space nonetheless serves as a reminder to Holyoke's former industrial and post-industrial eras by preserving the archeological ruins of a burned-out mill. As an individual piece of the overall, proposed pedestrian/cyclist experience, it is a small but noteworthy counterpoint to the bulk of the program that focuses on proactive reinvigoration.



SITE PLANNING

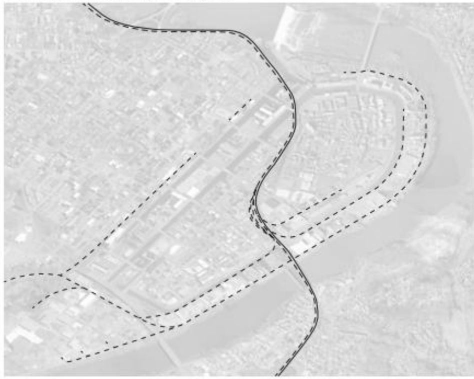


> **“During the past decade, Center City suffered significant disinvestment and outmigration that has resulted in excess supply of commercial and industrial buildings... there is more than 1.1 million square feet of industrial space available in Holyoke, with 91% of that available space located in Center City.”**
>
> —*Innovation-Based Economic Development Strategy for Holyoke and the Pioneer Valley*

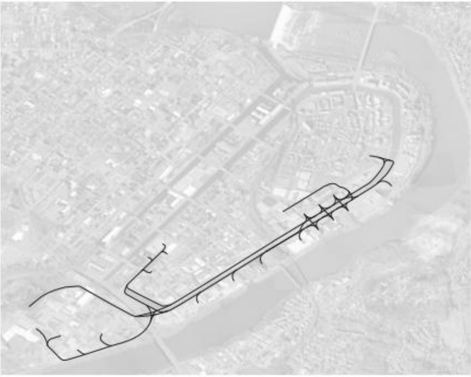
PROPOSED CONNECTIVE SYSTEM

The proposed Connective System is the backbone of the landscape infrastructure that will help foster industrial symbiosis. It relies on the reactivation of existing rail lines within/beyond Holyoke and the establishment of new ones along strategic paths. The system ties together key current and future industrial sites with a solar-powered train network that facilitates the exchange of materials within Holyoke itself and between Holyoke and the Springfield Materials Recycling Facility. The Connective System also provides for interchange connections to occur between larger, regional freight lines. Lastly, it also provides for the intended Amtrak passenger service that is set to begin in 2014.

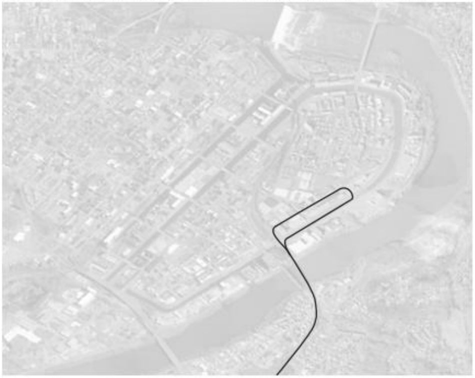
Existing rail lines in Holyoke



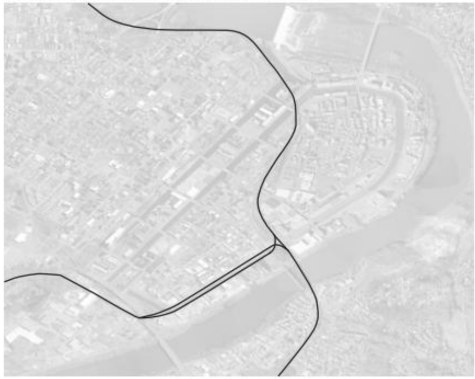
Proposed connective rail system for movement of goods within Holyoke



Proposed connective rail system for movement of materials between Holyoke and the Springfield MRF

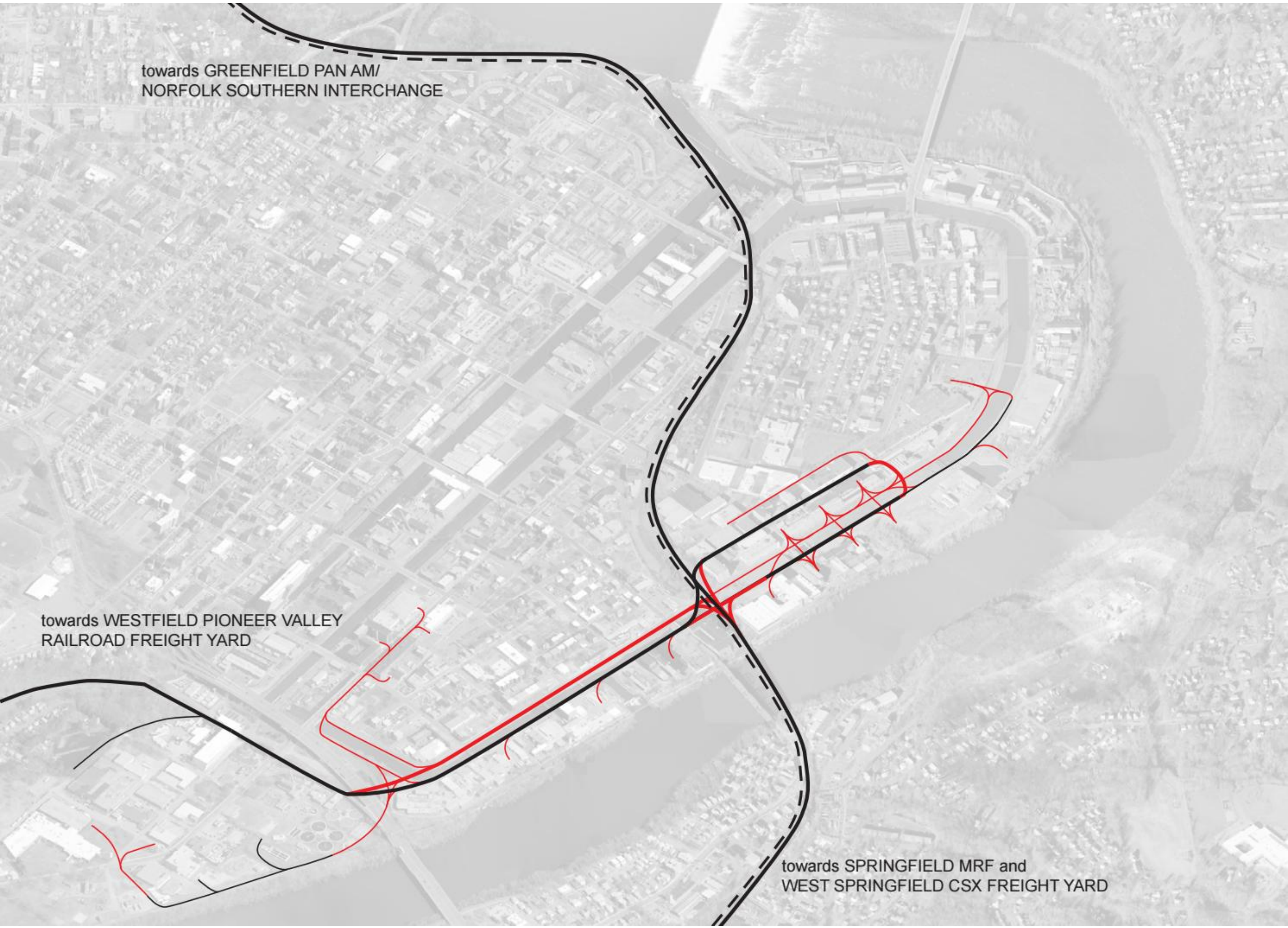


Proposed connective rail system for freight transportation beyond Holyoke



PROPOSED CONNECTIVE SYSTEM

– – – –	Dedicated Amtrak Line
—	Existing Rail Line: Intra-City Goods Movement
━	Existing Rail Line: Inter-City Goods Movement
—	Proposed Rail Line: Intra-City Goods Movement
━	Proposed Rail Line: Inter-City Goods Movement


towards GREENFIELD PAN AM/
NORFOLK SOUTHERN INTERCHANGE
towards WESTFIELD PIONEER VALLEY
RAILROAD FREIGHT YARD
towards SPRINGFIELD MRF and
WEST SPRINGFIELD CSX FREIGHT YARD

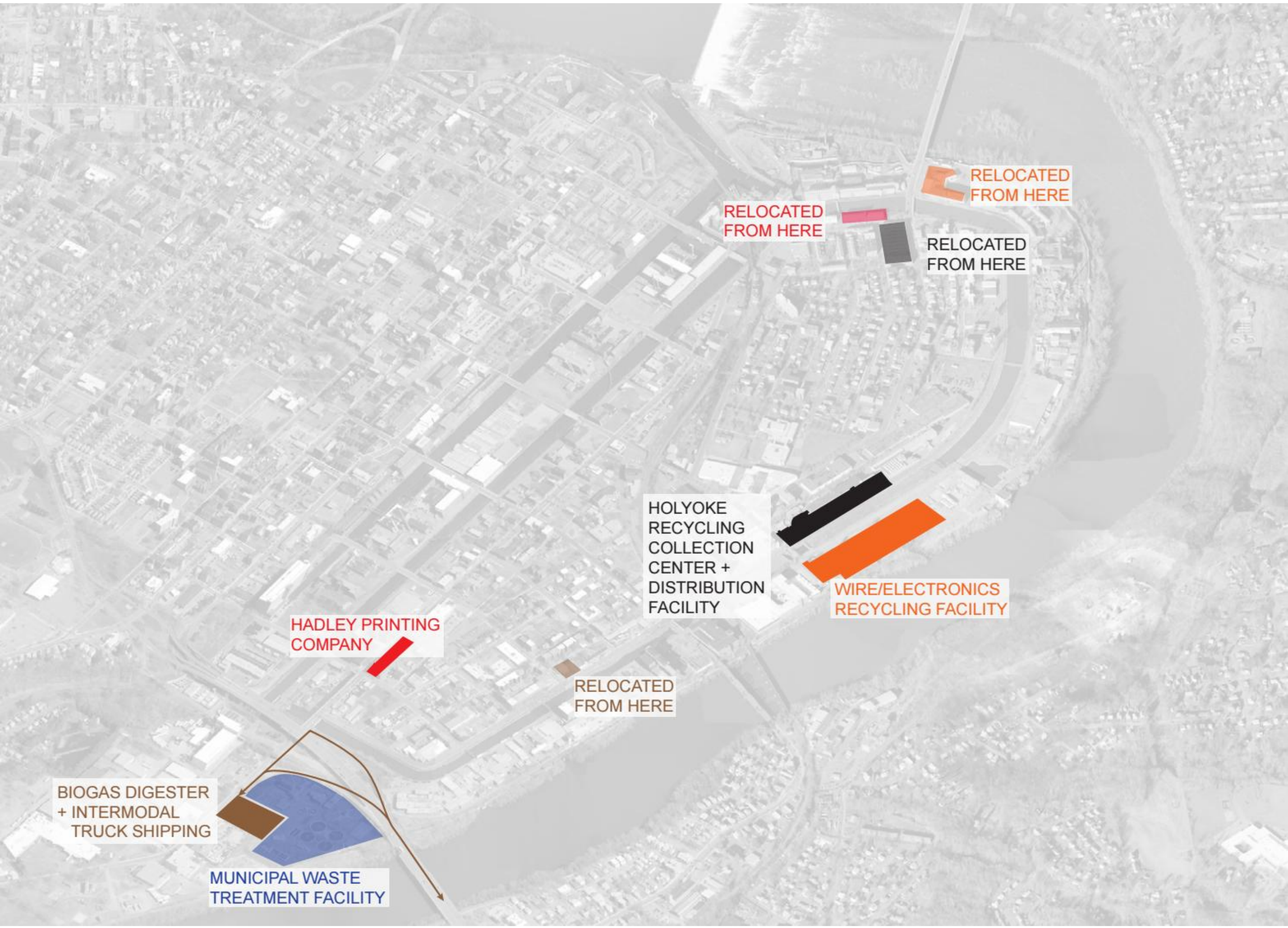
PROPOSED DISTRIBUTION CENTER + FACILITY RELOCATIONS

As mentioned on page 63, the proposed shipping and distribution center handles material produced by the recycling facilities that is not marked for immediate reuse within Holyoke. It stores that material either for future use within Holyoke or until it is ready to be shipped via freight or truck far beyond Holyoke's boundaries. It also doubles as Holyoke's Recycling Collection Center (relocated from its present location) and is strategically housed in a large, currently abandoned building near the confluence of the Connective System's rail lines. Together with the paper and e-waste recycling facility presented on the next 4 pages, the distribution center forms part of the Symbiotic Industrial Nerve Center.

Several other relocations are also suggested as important components to strengthening the efficiency of the Connective System. The existing e-waste recycling facility is enlarged to accommodate an increase of material and relocated to a more efficient, central location along the Connective System. Additionally, one printing company is relocated so that it may also take advantage of the Connective System.

The final, substantial proposed relocation of an existing facility is that of the Dennis K. Burke, Inc. company, which currently operates a biofuel facility in Holyoke. The company's focus is on the distribution of fuel products rather than the manufacture of them. This thesis proposes encouraging the company to relocate that facility to a larger, vacant lot immediately adjacent to Interstate 391's on/off ramps, which would allow for better freeway access for vehicular refueling. This site is also situated along one of the preexisting spurs of Holyoke's rail system, so it would additionally become a logical complement to the proposed Connective System.

Furthermore, the proposed location is also adjacent to the municipal waste treatment facility, which would allow for a potential collaboration to develop in which biofuel could be manufactured on site and made ready for immediate distribution.


RELOCATED
FROM HERE
RELOCATED
FROM HERE
RELOCATED
FROM HERE
HOLYOKE
RECYCLING
COLLECTION
CENTER +
DISTRIBUTION
FACILITY
WIRE/ELECTRONICS
RECYCLING FACILITY
HADLEY PRINTING
COMPANY
RELOCATED
FROM HERE
BIOGAS DIGESTER
+ INTERMODAL
TRUCK SHIPPING
MUNICIPAL WASTE
TREATMENT FACILITY

PROPOSED PAPER TRAIL

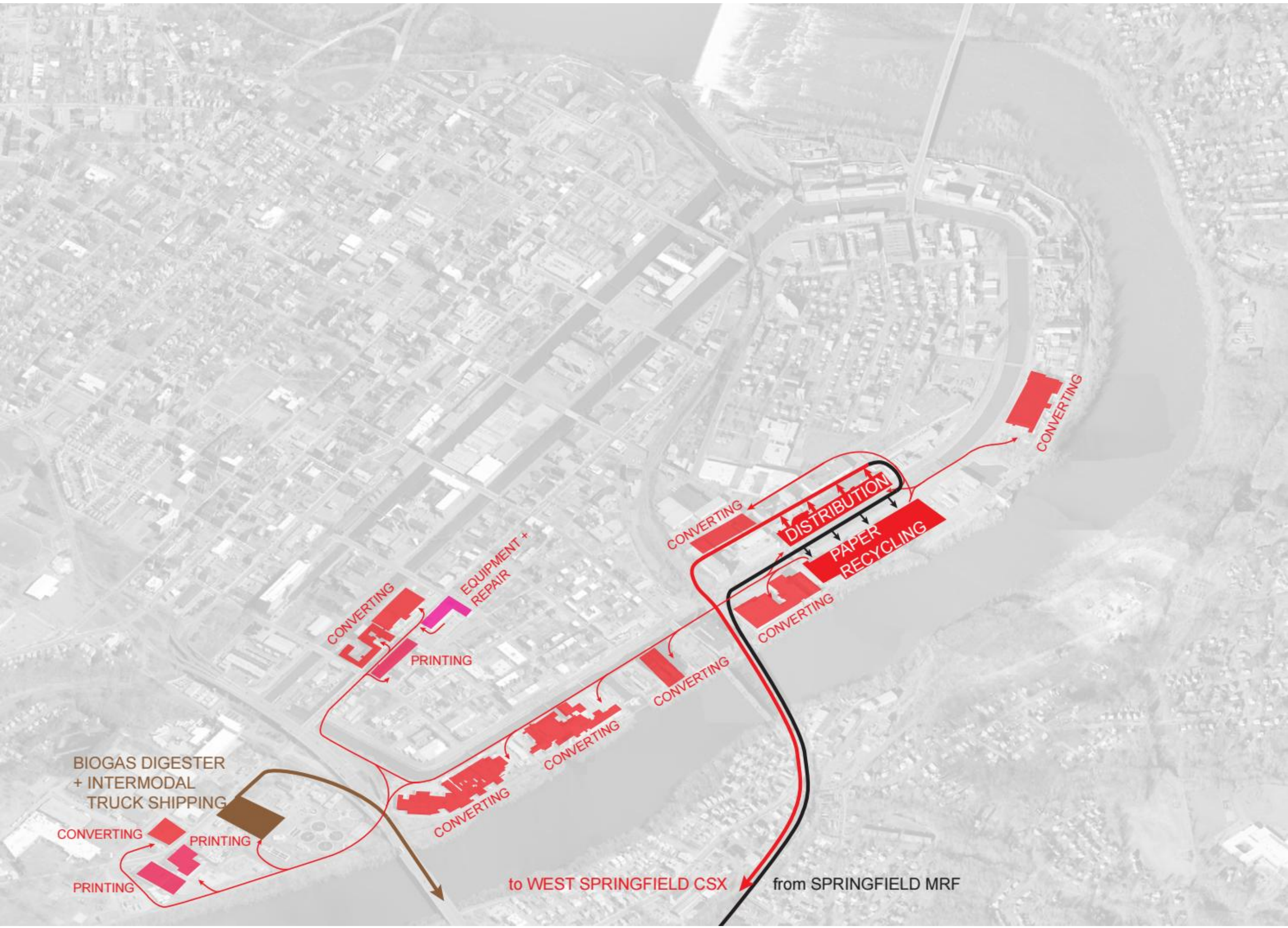
The proposed Paper Trail synthesizes Holyoke's existing paper conversion and printing activity with the proposed Connective System and the Springfield Materials Recycling Facility (as well as the immediately local Holyoke Recycling Center).

Because the Springfield MRF's primary concern is the collection and distribution of recycleable waste products rather than their actual reprocessing, it becomes a logical step to direct the stream of paper waste collected in Springfield to Holyoke for reprocessing and potential reuse by the city's contingency of paper converters and printers.

Once the paper has been processed and converted or printed, these private firms would then have access to the Connective System to distribute their products via CSX's large-scale freight facility in West Springfield, freight trucks awaiting pick-up at the relocated biofuels facility, or their own fleet of trucks (that would also benefit from being powered by biofuel acquired at the biofuel facility).

In the cases where reprocessed/converted/printed paper products would not be immediately shipped beyond Holyoke, the previously discussed new distribution center would handle the collection and shipping logistics for the various firms.

See pages 40 and 41 for more information about the specific paper-related companies currently operating in Holyoke.

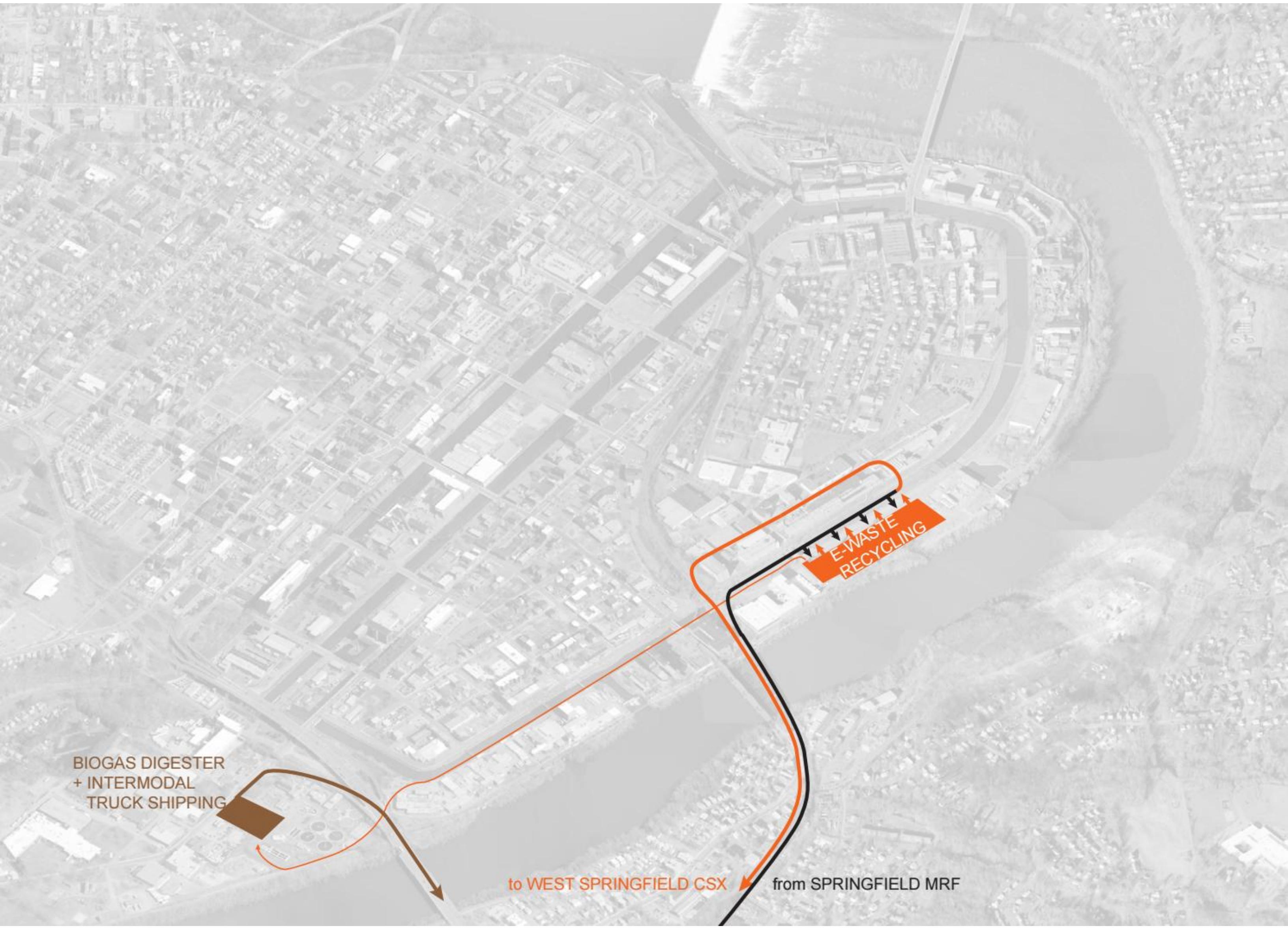

CONVERTING
DISTRIBUTION
CONVERTING
PAPER RECYCLING
EQUIPMENT + REPAIR
CONVERTING
CONVERTING
PRINTING
CONVERTING
CONVERTING
BIOGAS DIGESTER + INTERMODAL TRUCK SHIPPING
CONVERTING
CONVERTING
PRINTING
PRINTING
to WEST SPRINGFIELD CSX
from SPRINGFIELD MRF

PROPOSED E-WASTE TRAIL

The E-Waste Trail is similar to the Paper Trail in that it proposes a stream of waste from the Springfield MRF be directed to Holyoke for reprocessing via the proposed Connective System.

There are two private firms already working in the realm of e-waste recycling in Holyoke: Valley Mill Wire, LLC and Environmental Integrity, LLC.

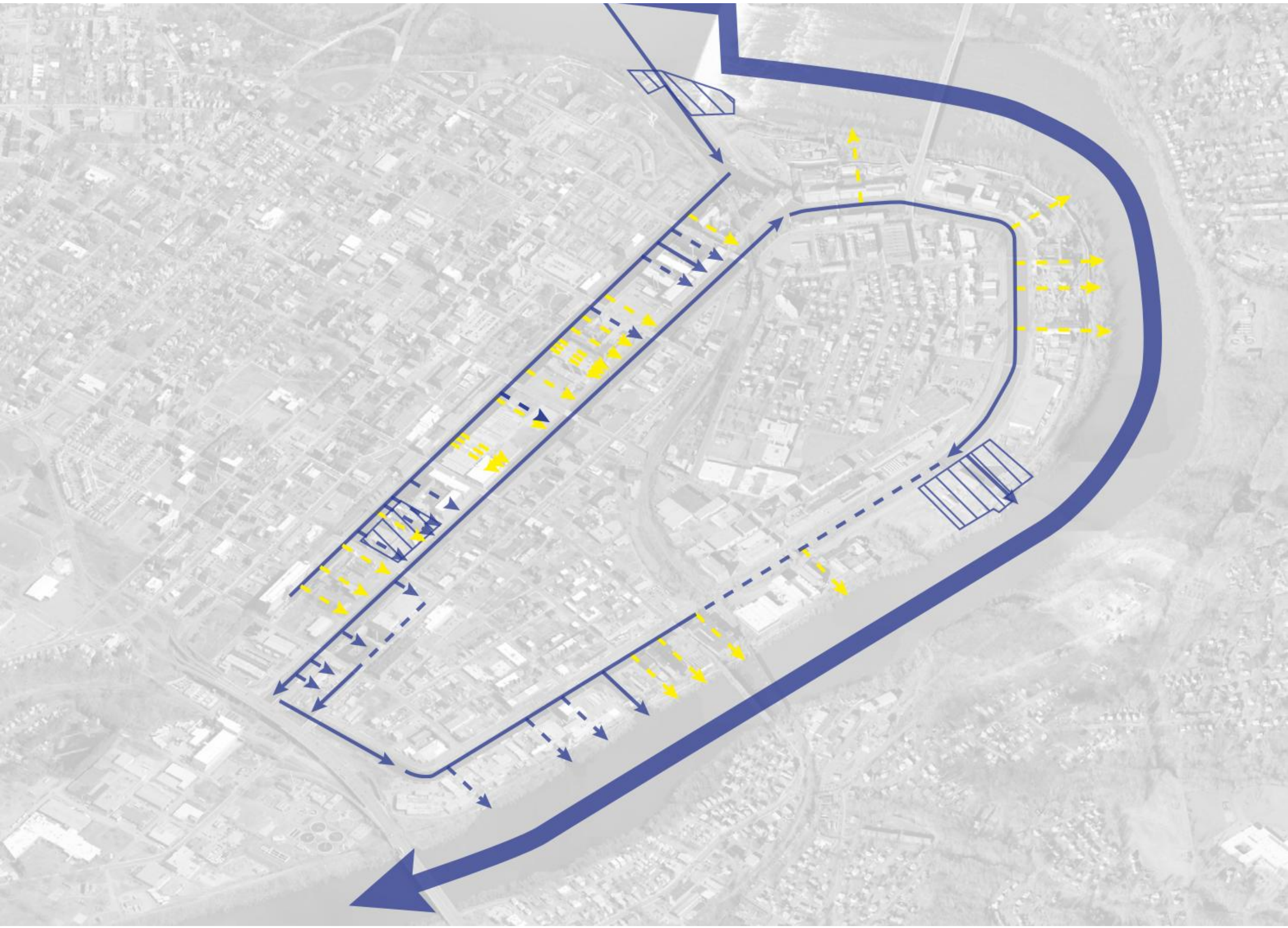
This aspect of the proposal calls for the expansion of this materials reprocessing capacity and for the reprocessed products to then be shipped beyond the city's boundaries in the same manner as described in the Paper Trail. If new businesses arise in the future that make use of the recovered materials, they may then acquire direct access to these materials via the Connective System.


E-WASTE RECYCLING
BIOGAS DIGESTER
+ INTERMODAL
TRUCK SHIPPING
to WEST SPRINGFIELD CSX
from SPRINGFIELD MRF

PROPOSED RACEWAY REACTIVATION

An estimated 25 of Holyoke’s 43 mill raceways are sealed at the gate, preventing the flow of water through them and their potential to generate hydro-electric power. Approximately 2/3 of Holyoke’s electricity is already generated by hydropower, so reopening these sluices and equipping them with hydro-electric generators would push Holyoke towards a completely clean-energy driven future. The reactivation of these races would also work well in conjunction with developing the city into a urban-scale clean energy research and development laboratory.

– – –	Inactive Raceway to be Reactivated
—	Active, Exposed/ Surface Canal/ Raceway Water Flow
– – –	Active, Below Surface Canal/Raceway Water Flow
▨	Holyoke Gas & Electric Facility



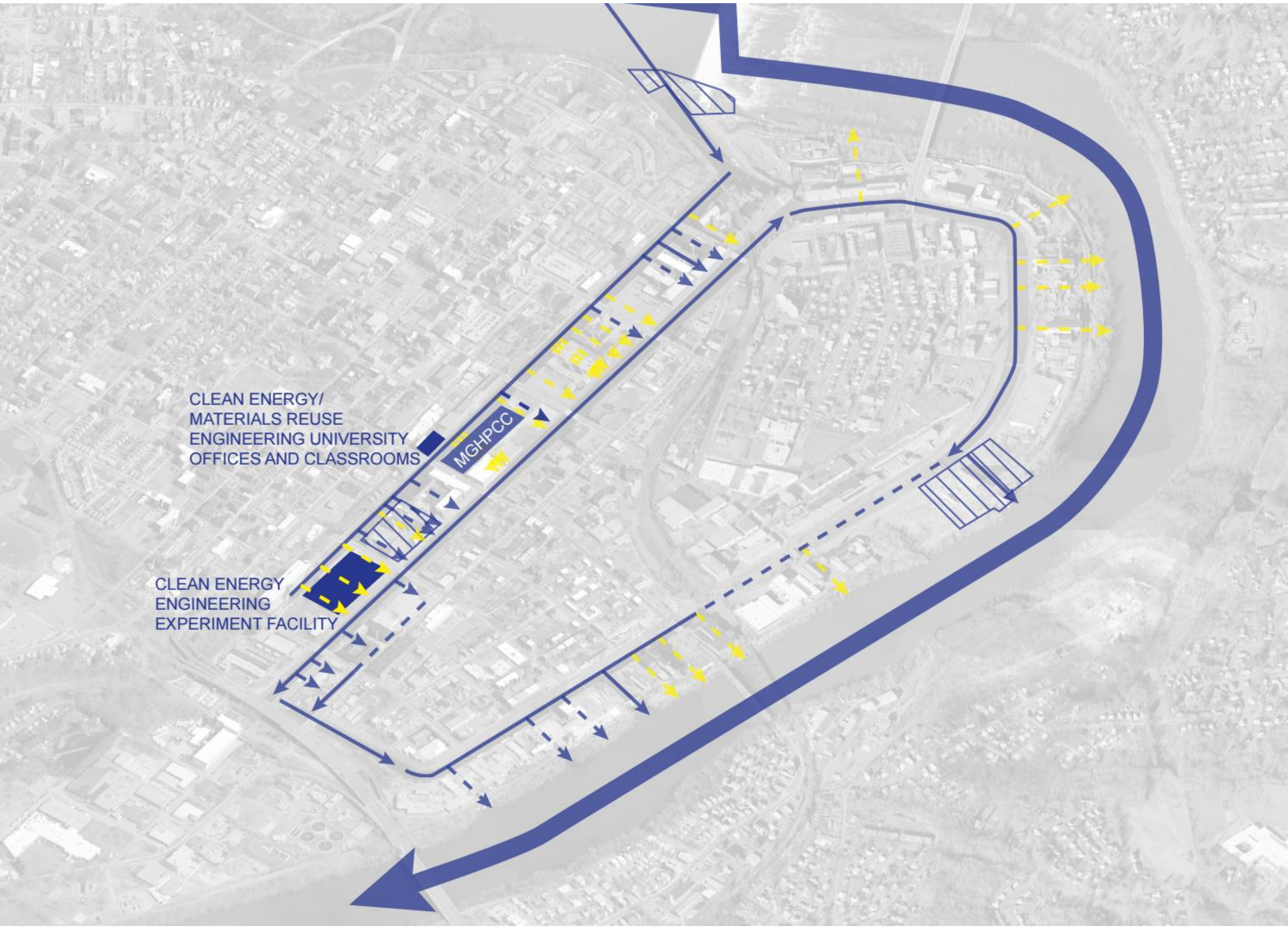
PROPOSED CLEAN ENERGY RESEARCH + DEVELOPMENT

The proposed experimental test space, office space, and classroom space operated by the UMass-Amherst engineering department all coalesce to become a lynchpin that ties the proposed industrial/clean-energy generating activity together with the city's arts/innovation initiative.

The former Parsons Paper Mill site becomes the experimental facility in which engineering researchers gain direct access to 3 of the city's unused mill raceways. Reactivating these raceways gives the researchers an opportunity to test new hydro-electric equipment and potentially make new discoveries for increasing efficiency in energy generated by hydropower. Discoveries made at this facility could then be deployed at later dates at other inactive-to-be-reactivated raceways throughout the city. In this manner, the city would attain a model of constant clean-energy self renewal. This space is also located just across Sargeant Street from one of Holyoke Gas and Electric's electrical facilities, so opportunities for collaboration become ripe.

More traditional classroom and office space for administrative tasks, guest lectures, and student seminars is located nearby in the southwestern most portion of the old Farr Alpaca building. This location is a short walk from the proposed experimental facility and directly across the 1st Level Canal from the Massachusetts Green High Performance Computing Center, so collaborative opportunities with it may also easily arise.

Lastly, with the city's preexisting and proposed materials reuse and biofuel operations, the engineering research space would also be ideally situated to conduct research into increasing the efficiency of those materials and processes as well.


CLEAN ENERGY/
MATERIALS REUSE
ENGINEERING UNIVERSITY
OFFICES AND CLASSROOMS
MGHPCC
CLEAN ENERGY
ENGINEERING
EXPERIMENT FACILITY

PROPOSED PUBLIC SPACES AND RECREATIONAL OPPORTUNITIES

To allow and encourage people to observe and engage with the reindustrialized landscape machine, improvements to Holyoke's public space need to be addressed and new recreational opportunities provided. The spatial arrangement of the proposed public spaces responds to the siting of the core industrial program as presented on the preceding pages. The same may be said of the theme around which each of these spaces is designated.

Directly across the 1st Level Canal from the Heritage State Park is the Hydro-Park in which a presently sealed raceway is reopened to allow people the opportunity to understand the manner in which the flow of water through the canal system powers the city. In summer months this space also becomes a prime site for evening concerts and a beer garden operated in conjunction with Paper City Brewing.

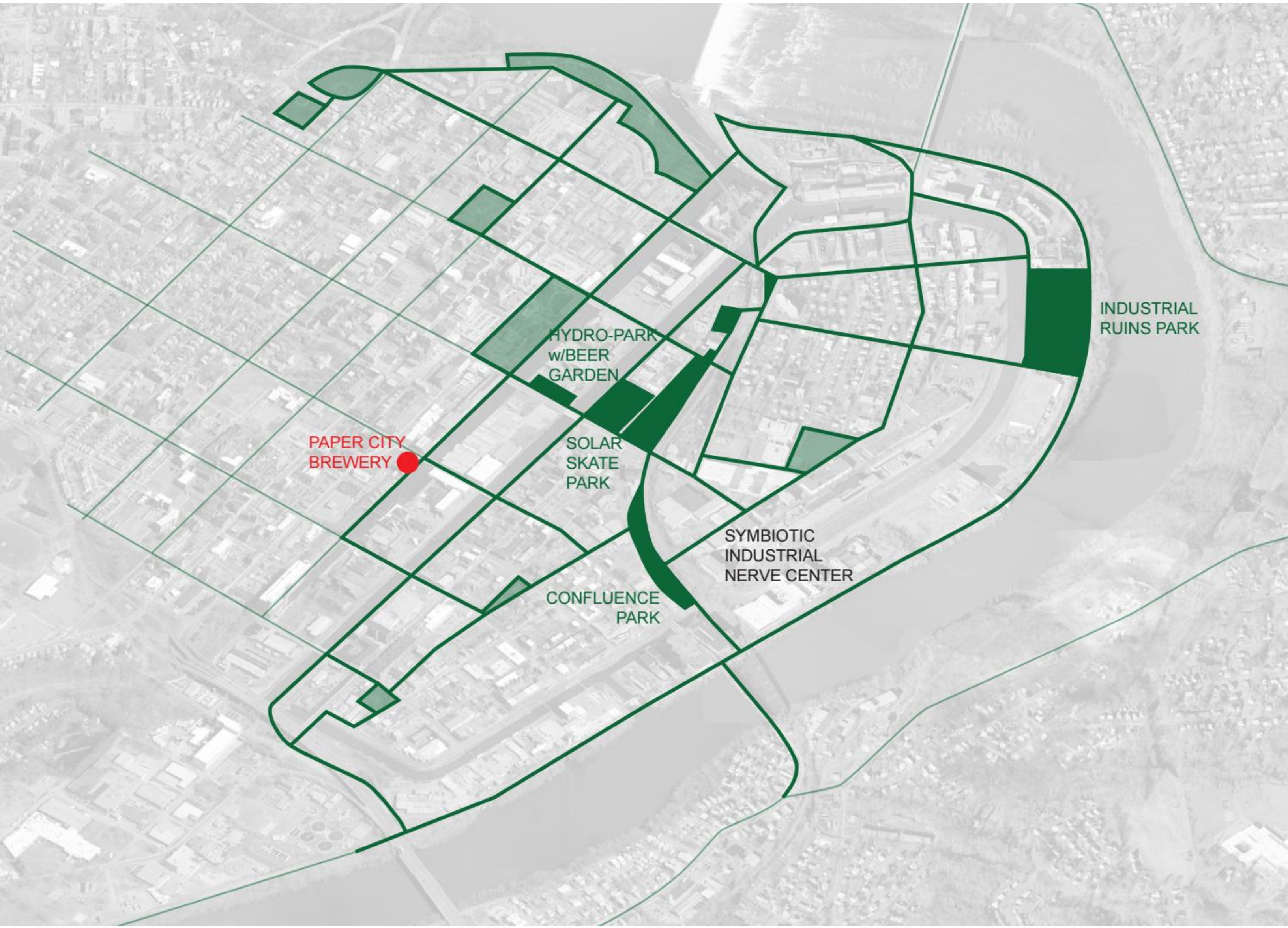
The Solar Skate Park lies across the 2nd Level Canal from the Hydro-Park and combines the recreational, concrete landscape architecture of a skate park with large plinths that support solar voltaic panels. The intention is to provide a safe, fun environment for local youths while also generating electricity in a very apparent, informative manner (and the voltaic panels also just so happen to provide moments of shade).

Confluence Park is a gently sloping earth mound that brings people in safe but close proximity to a long stretch of train activity. A large portion of the mound is formed with walls to allow for rock-climbing in a unique, industrial context. The mound also facilitates movement for walking and cycling and provides views of the bustling activity of the Symbiotic Industrial Nerve Center.

The Industrial Ruins Park is proposed to preserve the memory of Holyoke's 20th century industrial downfall by commemorating one of the burned-out mills as a space that provides pleasant access to the riverfront.

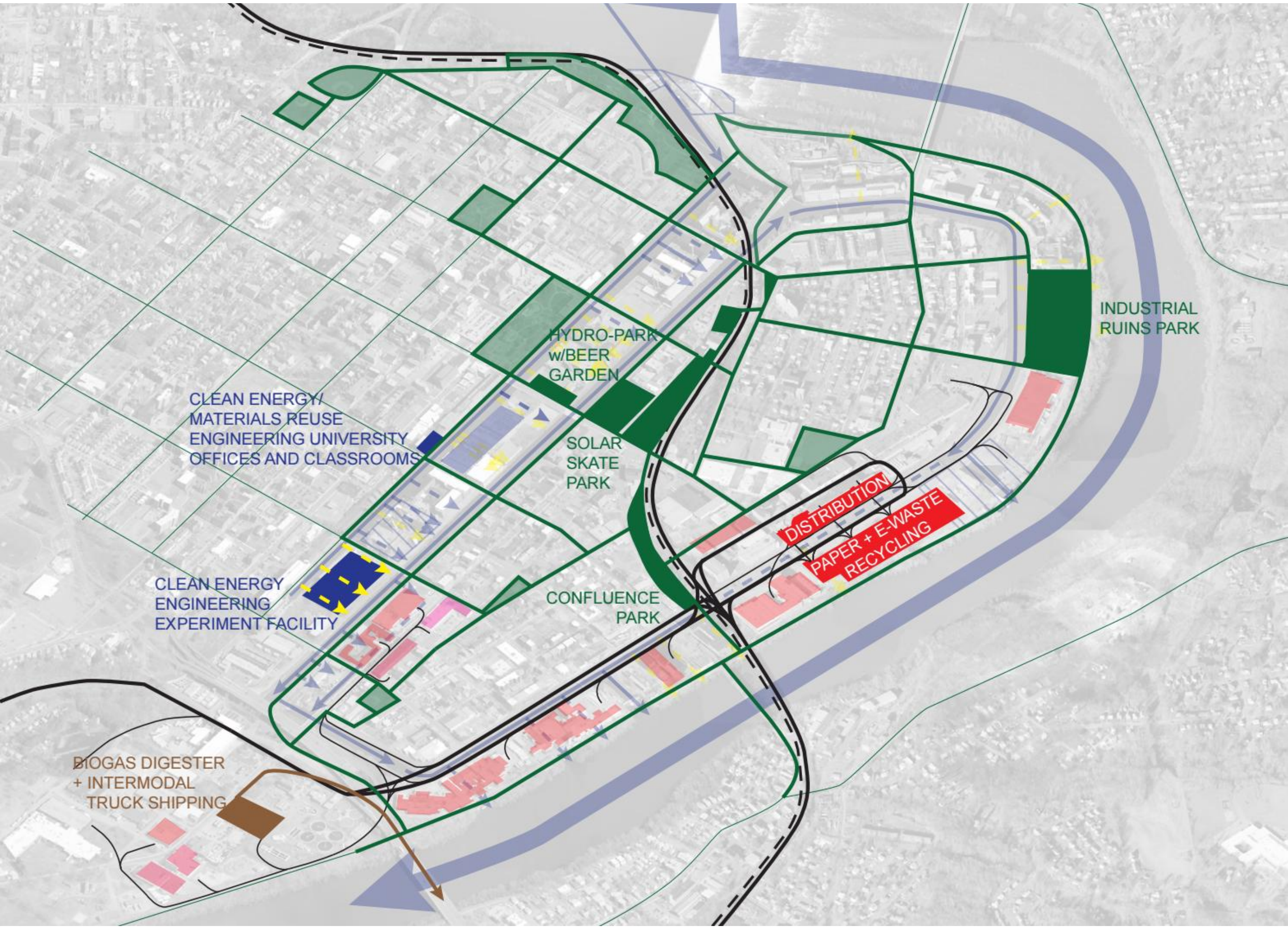
Lastly, a network of improved streetscapes for pedestrians and cyclists is proposed to connect these public spaces to the proposed industrial spaces.

— Proposed Pedestrian/ Cyclist Enhancements
🟩 Proposed Green Space
▨ Existing Green Space


HYDRO-PARK
w/BEER
GARDEN
INDUSTRIAL
RUINS PARK
PAPER CITY
BREWERY
SOLAR
SKATE
PARK
SYMBIOTIC
INDUSTRIAL
NERVE CENTER
CONFLUENCE
PARK

SYMBIOTIC SYNTHESIS

This spread illustrates how the proposed industrial, clean energy research and development, and recreational programming all synthesize with one another. It is essentially the masterplan that becomes the guide for the actual design work of this thesis.


HYDRO-PARK
w/BEER
GARDEN
INDUSTRIAL
RUINS PARK
CLEAN ENERGY/
MATERIALS REUSE
ENGINEERING UNIVERSITY
OFFICES AND CLASSROOMS
SOLAR
SKATE
PARK
DISTRIBUTION
PAPER + E-WASTE
RECYCLING
CLEAN ENERGY
ENGINEERING
EXPERIMENT FACILITY
CONFLUENCE
PARK
BIOGAS DIGESTER
+ INTERMODAL
TRUCK SHIPPING

PROPOSED CIRCULATION AND CONNECTIONS ACROSS RAIL LINES

To maintain the efficiency necessary for the proposed connective system, the vehicular traffic along South Canal Street needs to be rerouted to avoid congestion with the trains. This is achieved by diverting vehicular circulation to move along Main Street instead.

The central rail line of the Connective System poses an additional problem: it prevents movement of pedestrians and cyclists, which is contrary to the purpose of this thesis. For people to be able to engage with the infrastructure, they need to be able to move around and access it. New connections are therefore proposed that allow for pedestrians and cyclists to move across the rail lines in locations where such movement was not previously possible. In some cases these connections bridge over the rail lines, in others they dig underneath them.

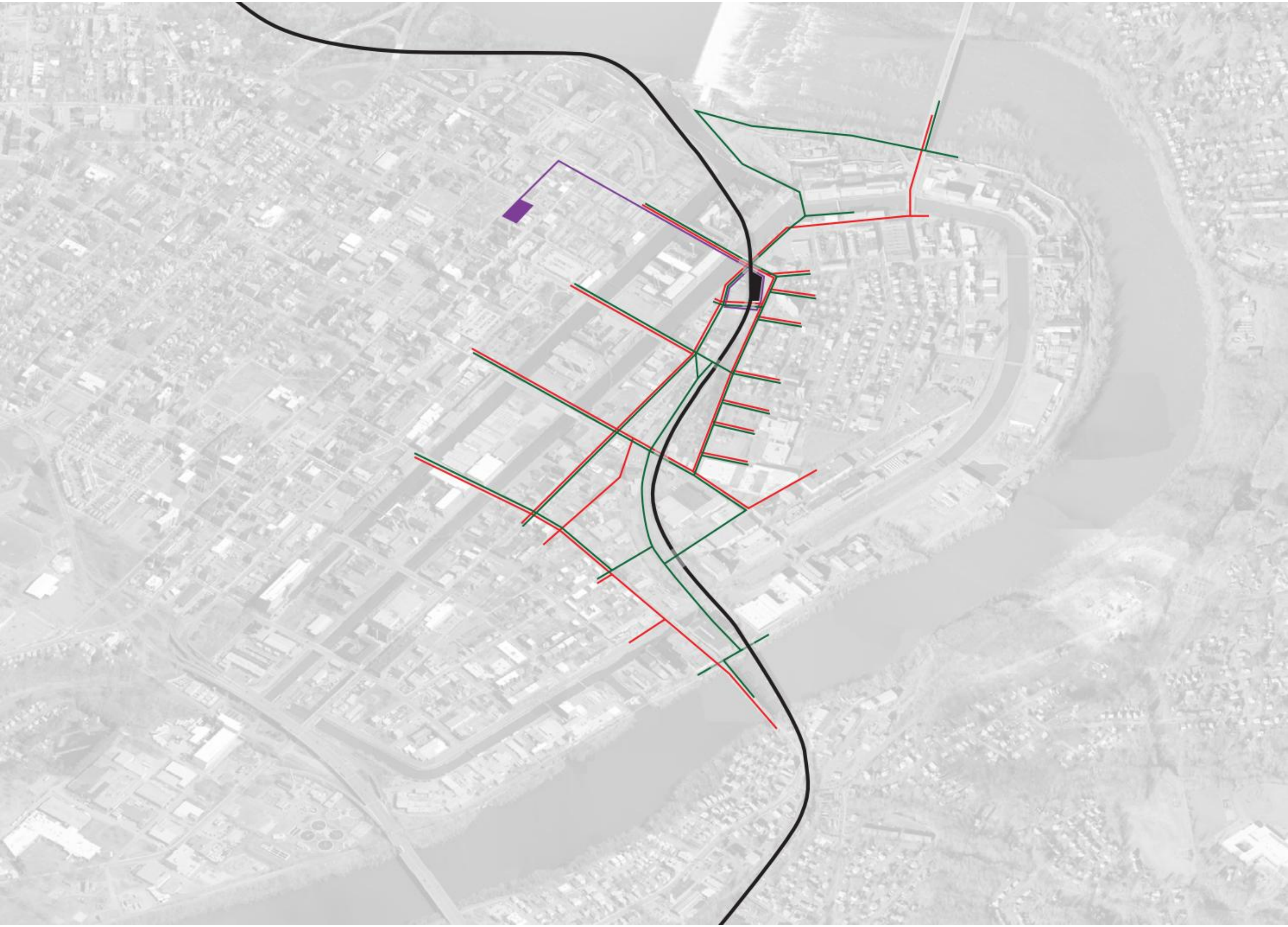
Lastly, because the Holyoke bus station is located two canals away from the projected transit-oriented district, a circulation pattern that connects the buses to the train station is proposed as well.

━ Rail Lines

— Vehicular Traffic

— Pedestrian/Cyclist Paths

— Bus Route



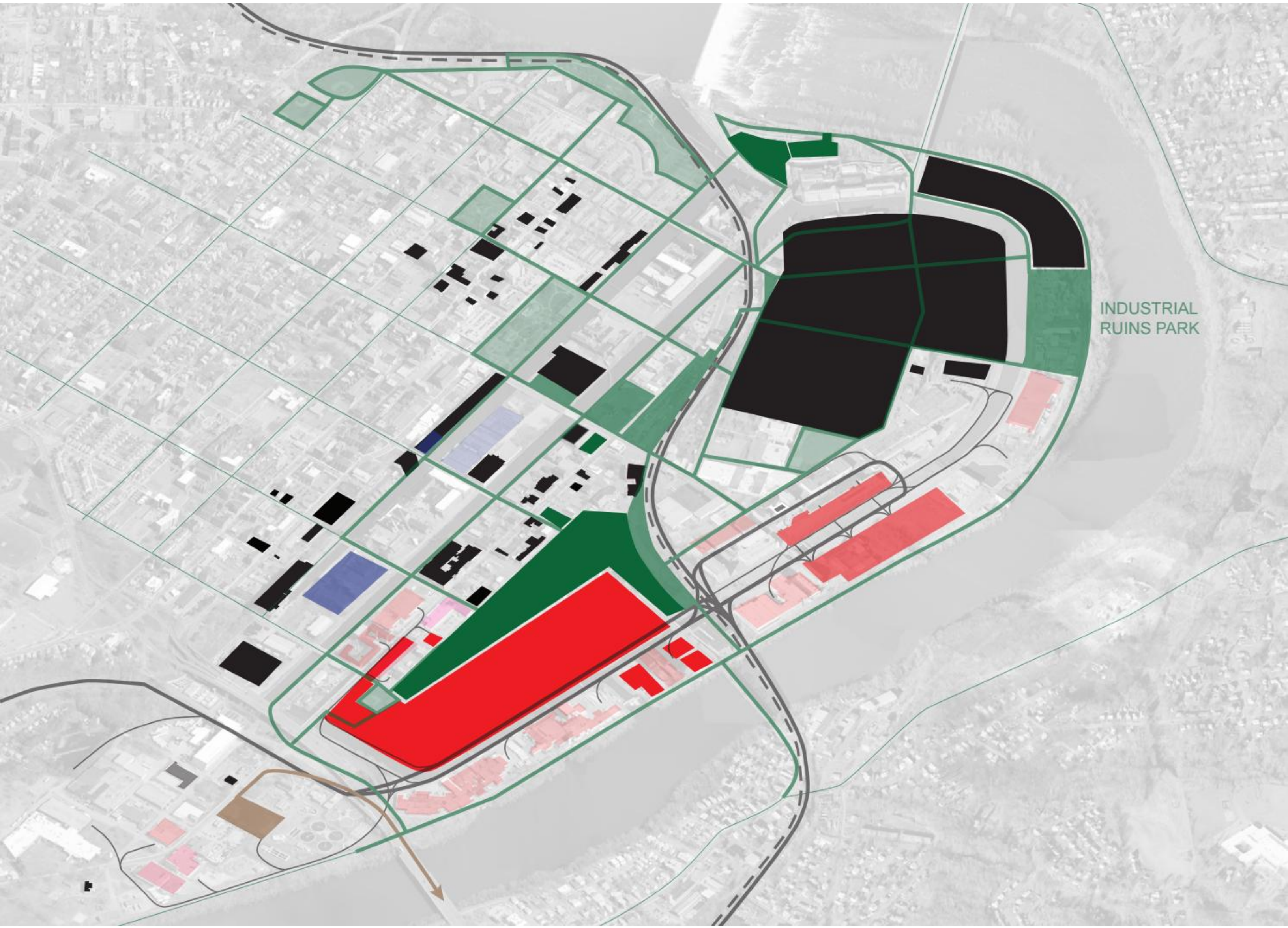
FUTURE INFILL/ZONING

The proposals presented on the preceding pages only address a small portion of Holyoke's abandoned buildings and vacant land. Development beyond the implementation of these proposals, however, may either strengthen or weaken the intended overall symbiotic harmony. General suggestions for future land use are therefore provided here.

Industrial land expands around the existing core along the 3rd Level Canal in South Holyoke, which would also allow for easy expansion of the proposed Connective System. This is also the part of the city with the highest concentration of high quantity toxic materials users (see pages 42 and 43), so it makes sense to concentrate additional industrial activity in this area and to provide a green space buffer zone between it and areas of permanent inhabitation. Building stock in this area is also of generally poorer quality than the part of Center City that lies to the east of the tracks—both in terms of abandoned and occupied buildings. South Holyoke also tends to be subjected to more flooding than other parts of the city, so moving its residential areas to higher, safer ground seems to be a sound decision.

Expanded residential, commercial, and institutional uses are additionally suggested for the northern part of Center City—the area northwest of the 1st Level Canal. This area is already the commercial and institutional hub of Holyoke, home to the bus station, and within close proximity to the planned Amtrak stop.

⬛ Residential/Commercial/Institutional
🟥 Industrial
🟩 Green Space
▬ Pedestrian/Bikeways


INDUSTRIAL
RUINS PARK

SITE DESIGN

578
VI
578
PIONEER VALLEY
578

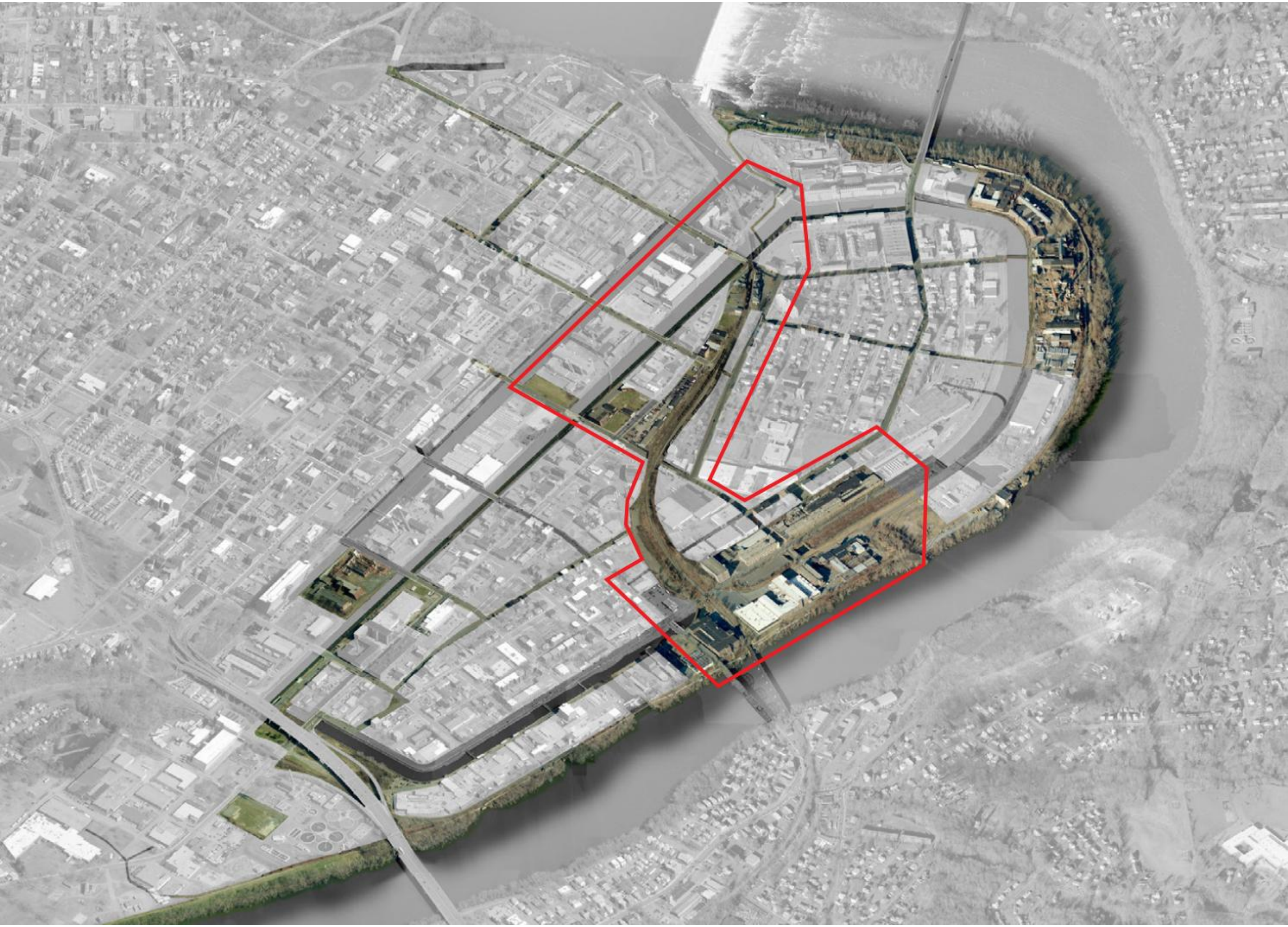
FOCUSING THE DESIGN

Completing a detailed design for the entire plan presented in the preceding pages is not a possible task given the time constraints of the thesis project itself.

The portion selected for specific design work must then be focused on a smaller area, which is shown to the right. This particular area has been selected because it provides a strong cross-section of all of the various programmatic elements proposed in this thesis. Specifically, it includes the area of the Symbiotic Industrial Nerve Center, Confluence Park, the Hydro-Park, and the Solar Skate Park, as well as the central rail line of the Connective System and the new, proposed connections that cross it.

The design suggestions that follow not only take into consideration the logistical needs as outlined in the preceding analysis and planning portions of this book, but also the experiential, human factor. While this thesis deals substantially with larger systems and their associated issues, it is within this design section that the human experience factor is addressed with the most depth.

The proposed landscape infrastructure is just as concerned with the enjoyment of the human experience as it is with the efficient exchange of industrial flows.



SITE PLAN

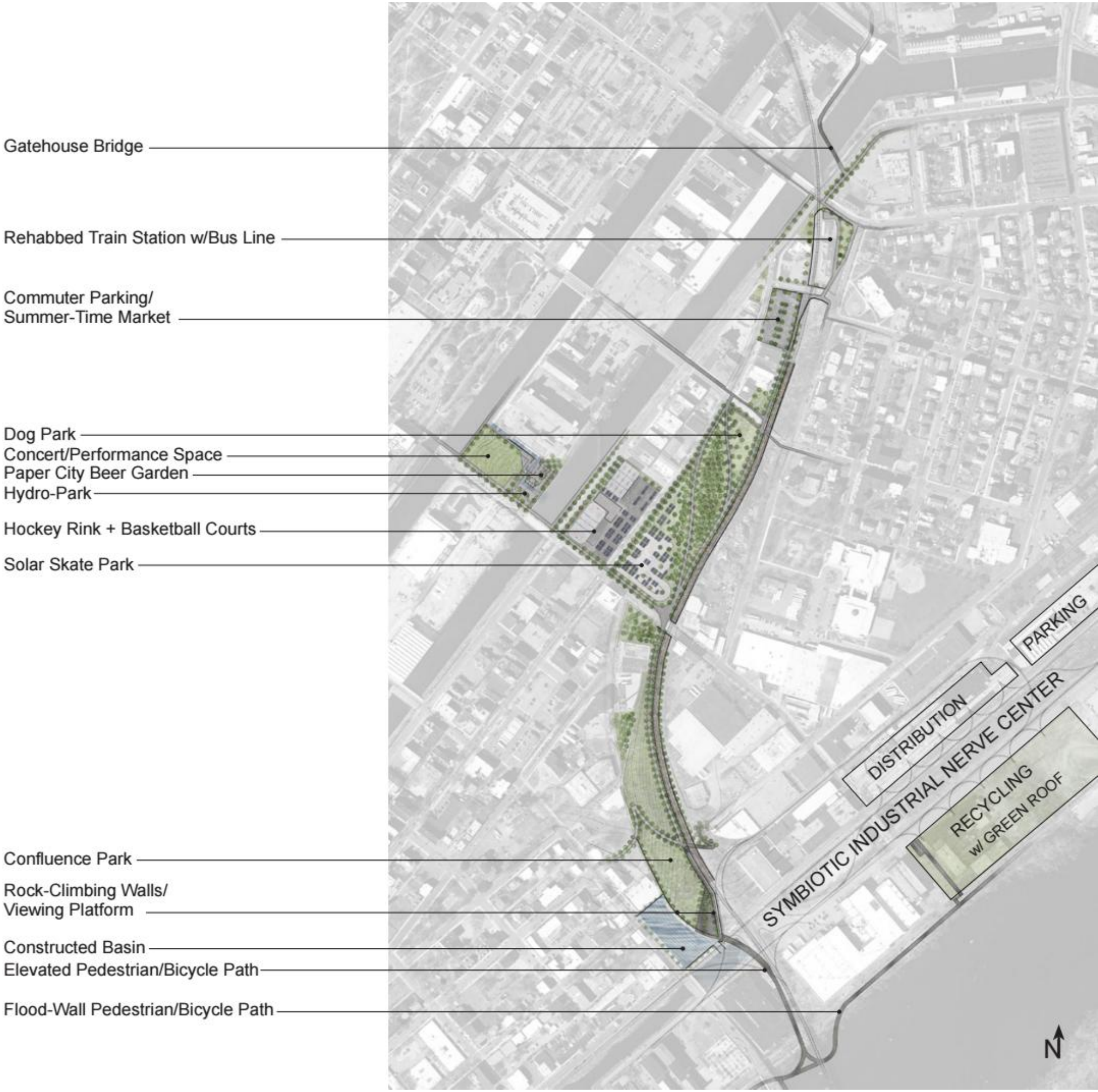
The site plan to the right illustrates the design as suggested for the area presented on the previous page.

The full extent of this stretch of land is approximately a mile long from north to south, and features a large amount of vacant land and abandoned buildings available for reuse. In addition to the recreational anchors of the Hydro-Park, the Solar Skate Park, and Confluence Park, several other recreational opportunities are seized in the form of a winter-time ice rink, basketball courts, a dog park, and a summer-time outdoor market.

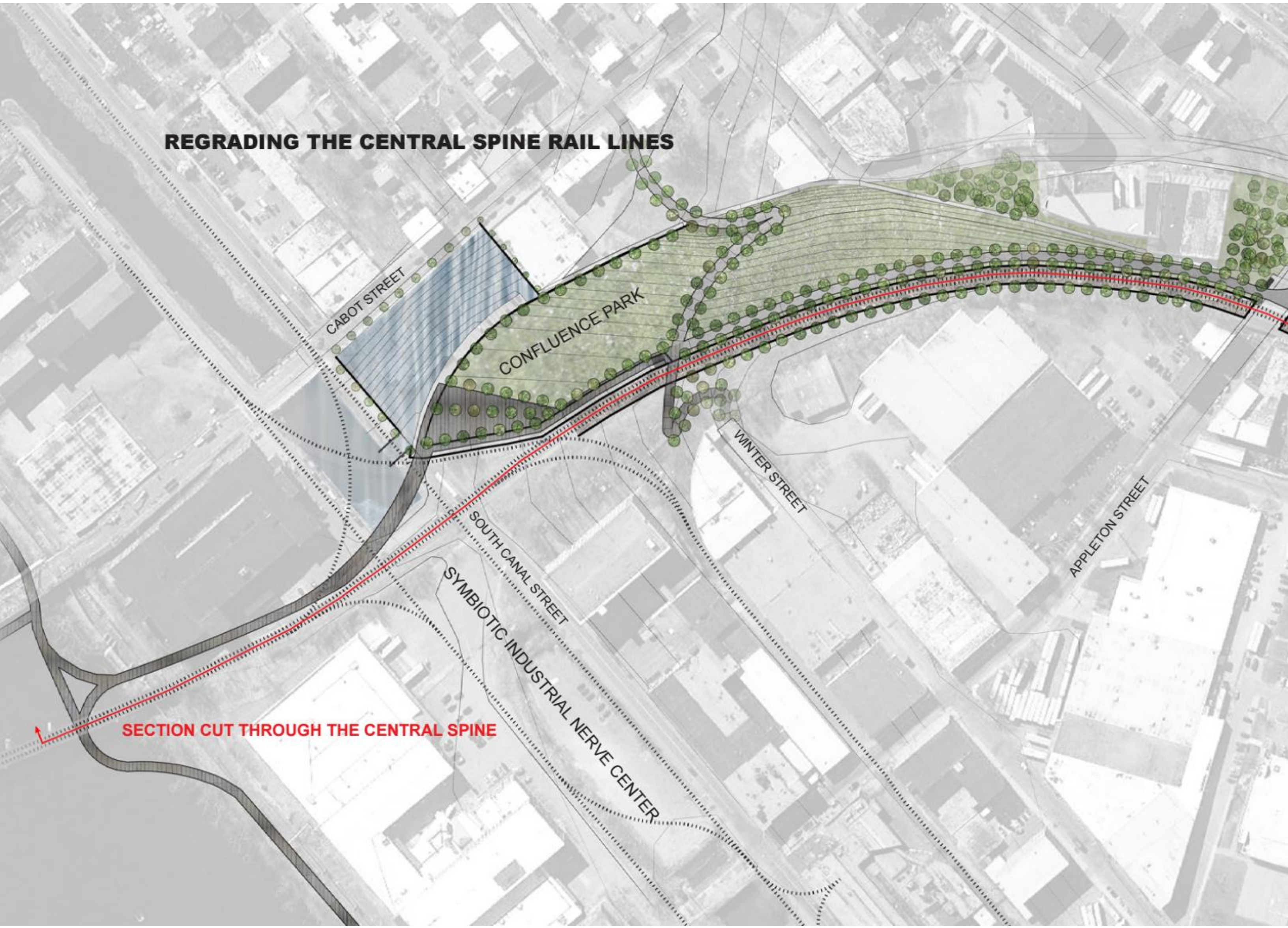
The crucial industrial anchors and Connective System are outlined but not designed to the same degree of detail as the recreational anchors. Even so, the recycling facility nonetheless becomes accessible to users of the pedestrian/bicycle path in the form of a green roof with unobstructed views of the Symbiotic Industrial Nerve Center.

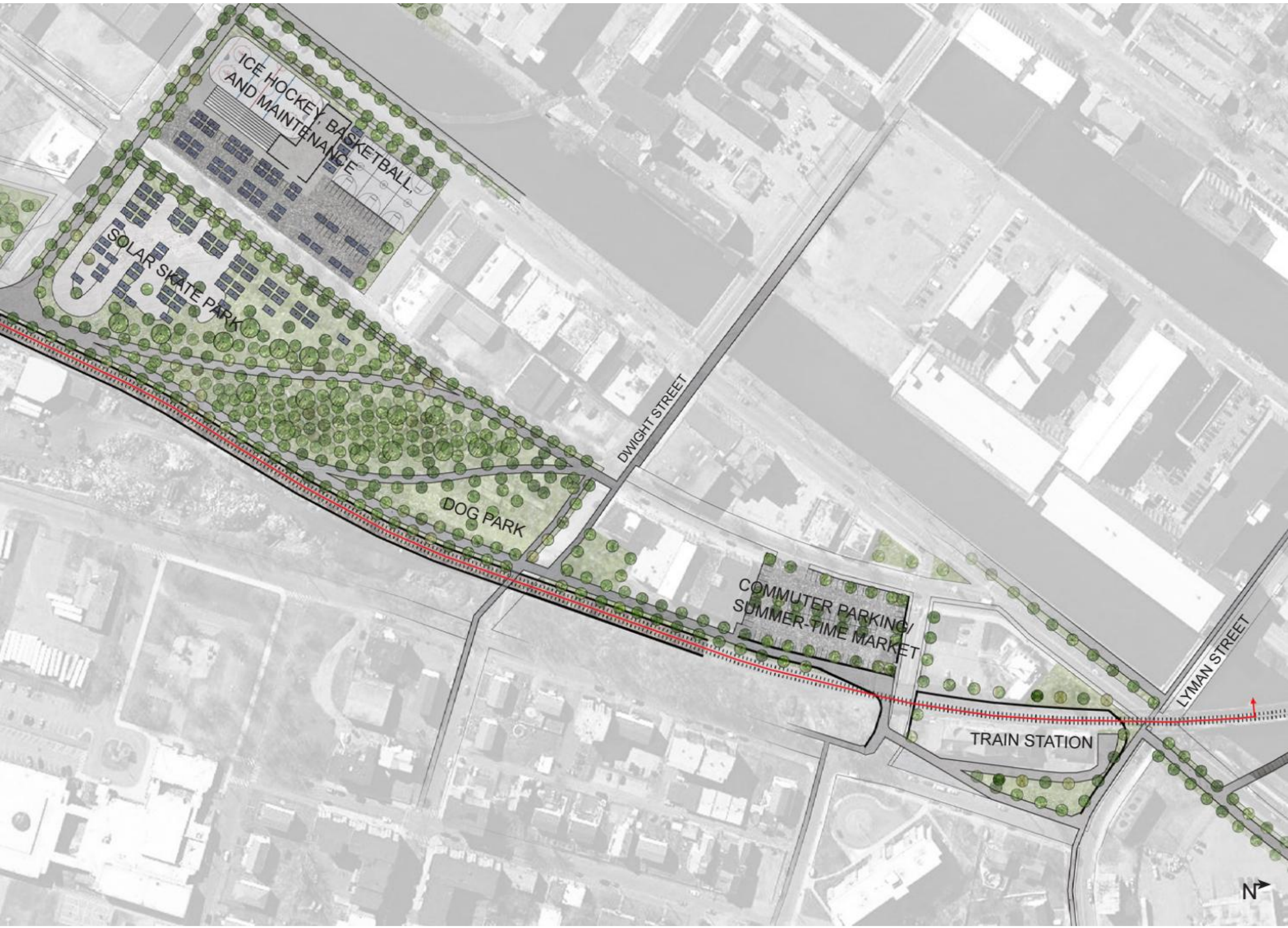
Future design development for specific industrial facilities would require collaboration with transportation engineers and architects, but the basic logistics of their siting and spatial dimensions as proposed here remain sound.

These facilities are all denoted in the image presented to the right while the following pages focus on the specifics of the selected individual, designed spaces.


Gatehouse Bridge
Rehabbed Train Station w/Bus Line
Commuter Parking/ Summer-Time Market
Dog Park
Concert/Performance Space
Paper City Beer Garden
Hydro-Park
Hockey Rink + Basketball Courts
Solar Skate Park
Confluence Park
Rock-Climbing Walls/ Viewing Platform
Constructed Basin
Elevated Pedestrian/Bicycle Path
Flood-Wall Pedestrian/Bicycle Path
PARKING
DISTRIBUTION
SYMBIOTIC INDUSTRIAL NERVE CENTER
RECYCLING w/ GREEN ROOF
N

REGRADING THE CENTRAL SPINE RAIL LINES




ICE HOCKEY, BASKETBALL, AND MAINTENANCE
SOLAR SKATE PARK
DOG PARK
DWIGHT STREET
COMMUTER PARKING/ SUMMER-TIME MARKET
TRAIN STATION
LYMAN STREET
N

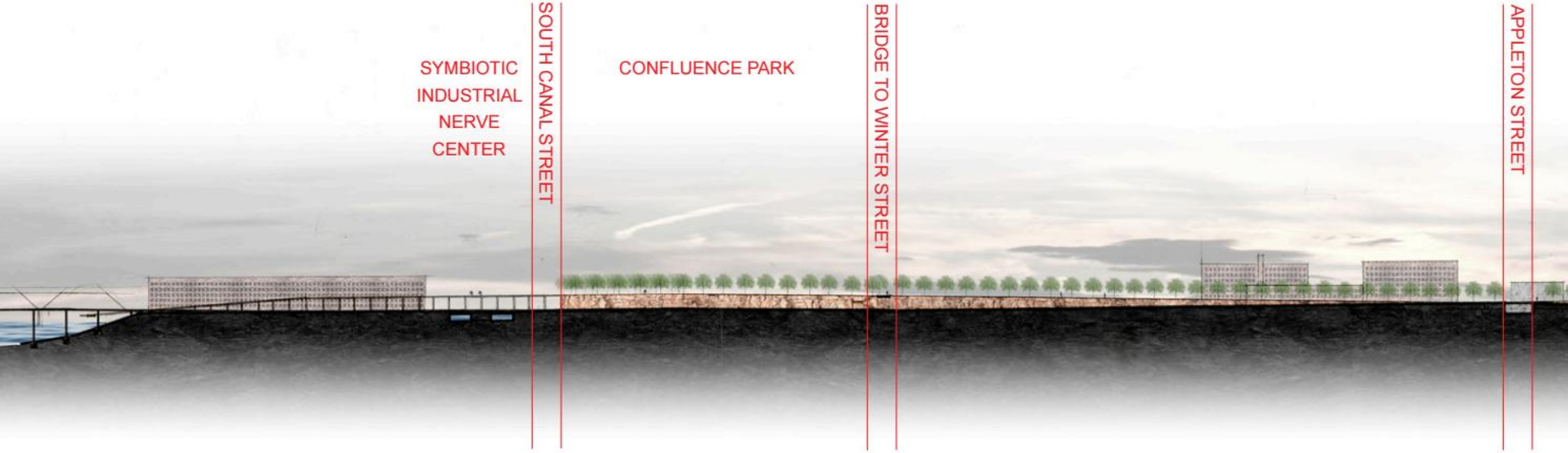
SECTION CUT THROUGH THE CENTRAL SPINE

The red cut line through the twisting and curving of the rail tracks on the preceding spread indicates the location of the section elevation illustrated below.

This drawing shows the relation between the Connective System's industrial rail infrastructure and the recreational activity that occurs around it from the Connecticut River's edge to the 2nd Level Canal.

Regrading the rail corridor to a slightly lower elevation just north of South Canal Street allows for a pedestrian/bicycle bridge to join Winter Street with the Confluence Park while still allowing for a 20'2" clearance for double-stacked train egress, which can be seen below. This stretch of track slopes downward from just north of South Canal Street towards the Winter Street bridge at 1.25%. From there the tracks slope upward again towards Appleton Street at a very subtle 0.8% over a 1000' stretch to meet the existing grade at the existing retaining wall and the rail bridge that spans over Appleton Street.

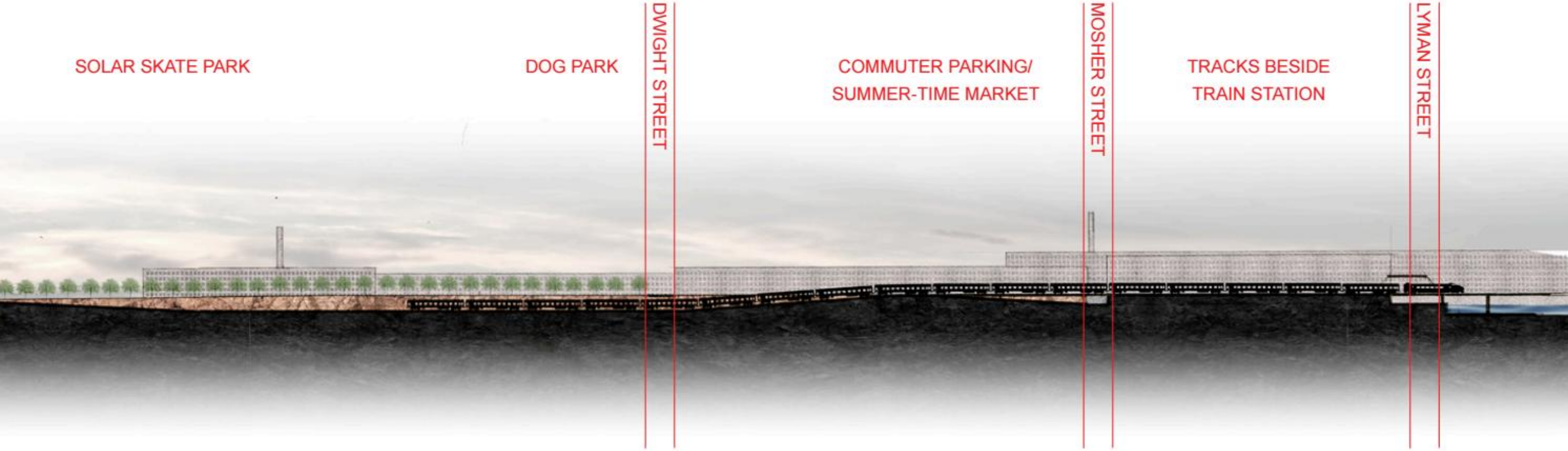
Between Appleton and Mosher Streets the tracks dive down again to allow for a new, improved connection for pedestrians and cyclists at Dwight



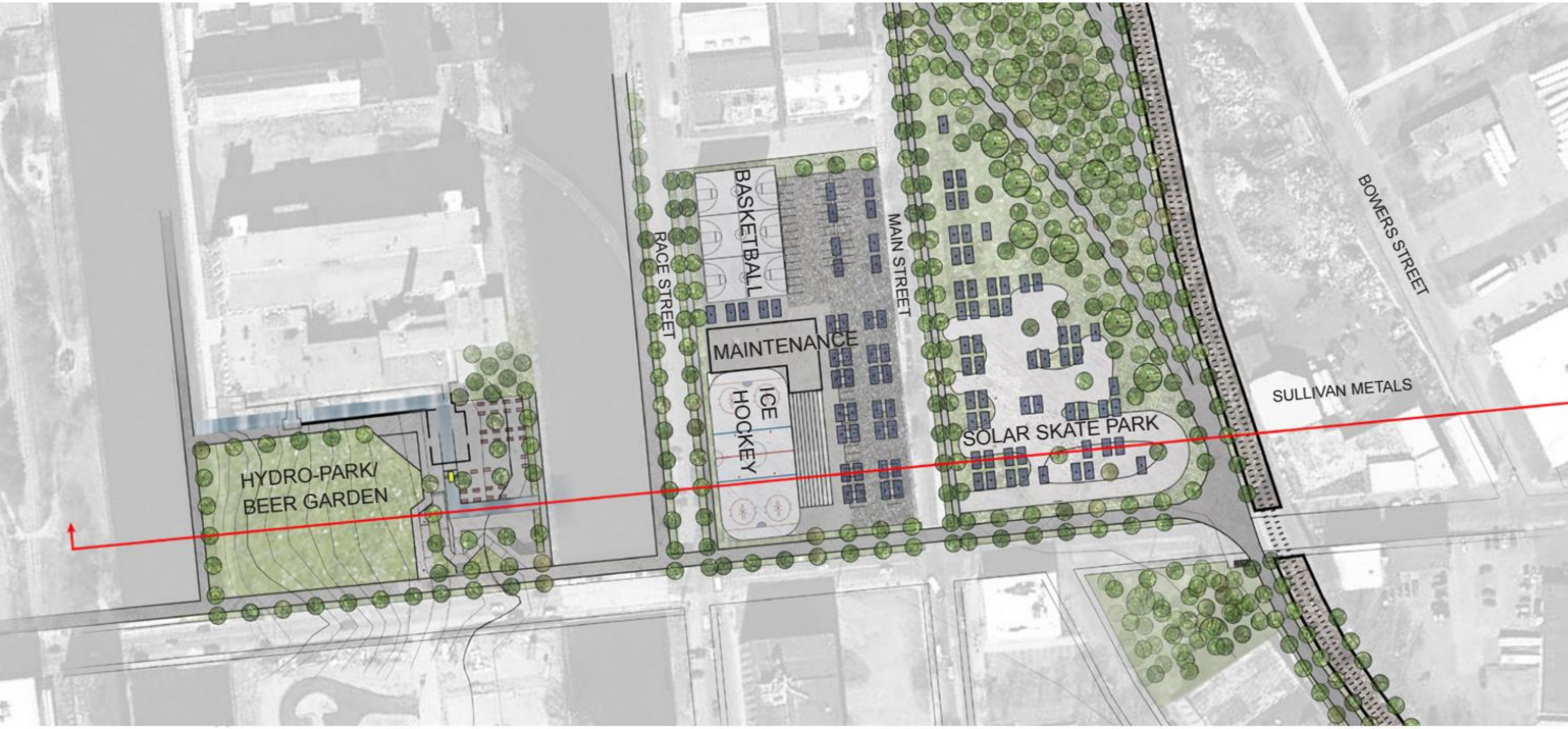
Street. The tracks are graded at 6.5% at both ends to reach the necessary 20'2" depth at which they remain for a 700' stretch. The tracks again return to their existing grade between Dwight and Mosher Streets before bridging over Mosher Street, allowing the new pedestrian/bicycle path to cross underneath in order to reach the train station between Mosher and Lyman Streets. After reaching the train station, the tracks continue via an existing bridge over Lyman Street and the 2nd Level Canal.

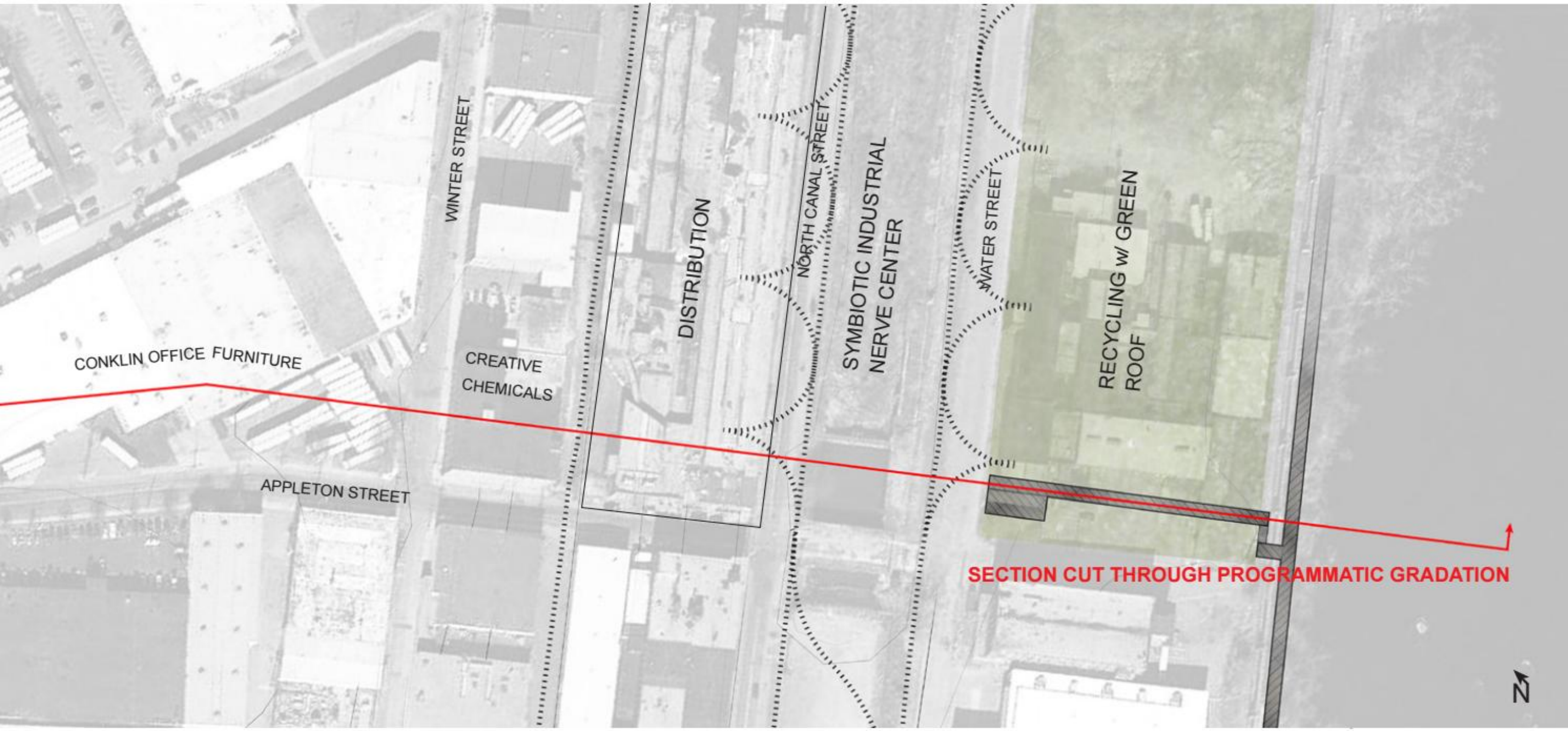
In addition to showing changes in the vertical dimensions of the path and its relation to street crossings, the section below also provides a glimpse of information in elevation. The elevated pedestrian/bicycle bridge is shown passing over the 3rd Level Canal and the Symbiotic Industrial Nerve Center. Confluence Park is seen to the right of this, where it slopes upward from Appleton Street at a gradual 1.2% till it reaches the viewing platform/rock-climbing walls that adjoin the elevated pedestrian/bicycle bridge.

Throughout the image the tracks and other new infrastructure are shown in relation to the location of the existing mill buildings in the distance.



GRADATION OF INDUSTRIAL AND RECREATIONAL PROGRAMMING

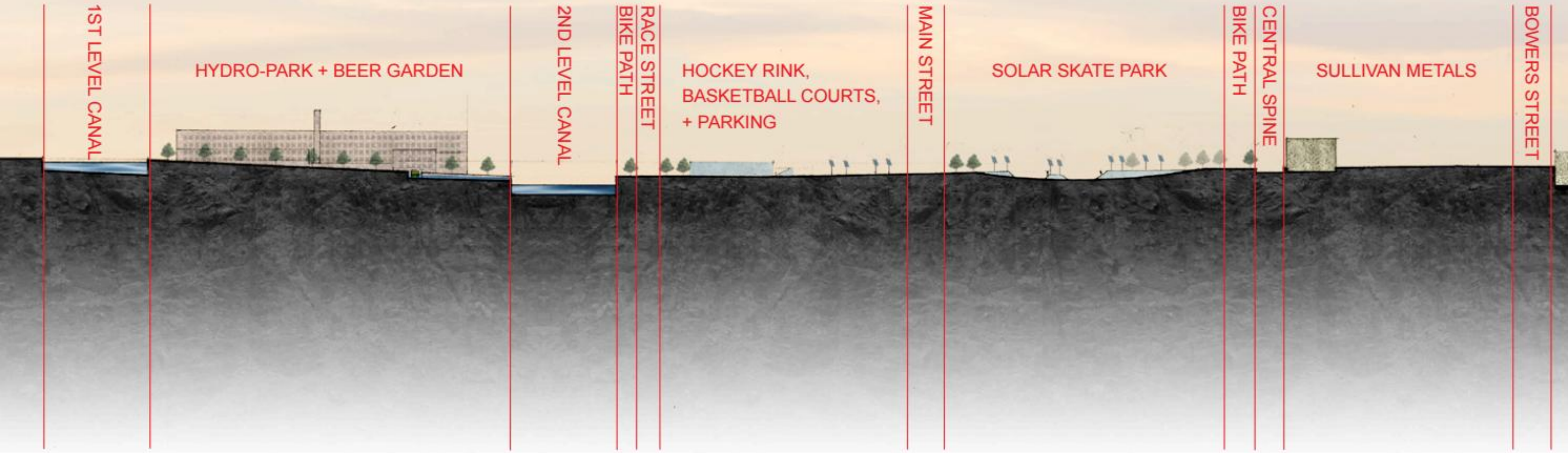



CONKLIN OFFICE FURNITURE
WINTER STREET
CREATIVE CHEMICALS
APPLETON STREET
DISTRIBUTION
NORTH CANAL STREET
SYMBIOTIC INDUSTRIAL NERVE CENTER
WATER STREET
RECYCLING w/ GREEN ROOF
SECTION CUT THROUGH PROGRAMMATIC GRADATION
N

SECTION CUT THROUGH PROGRAMMATIC GRADATION

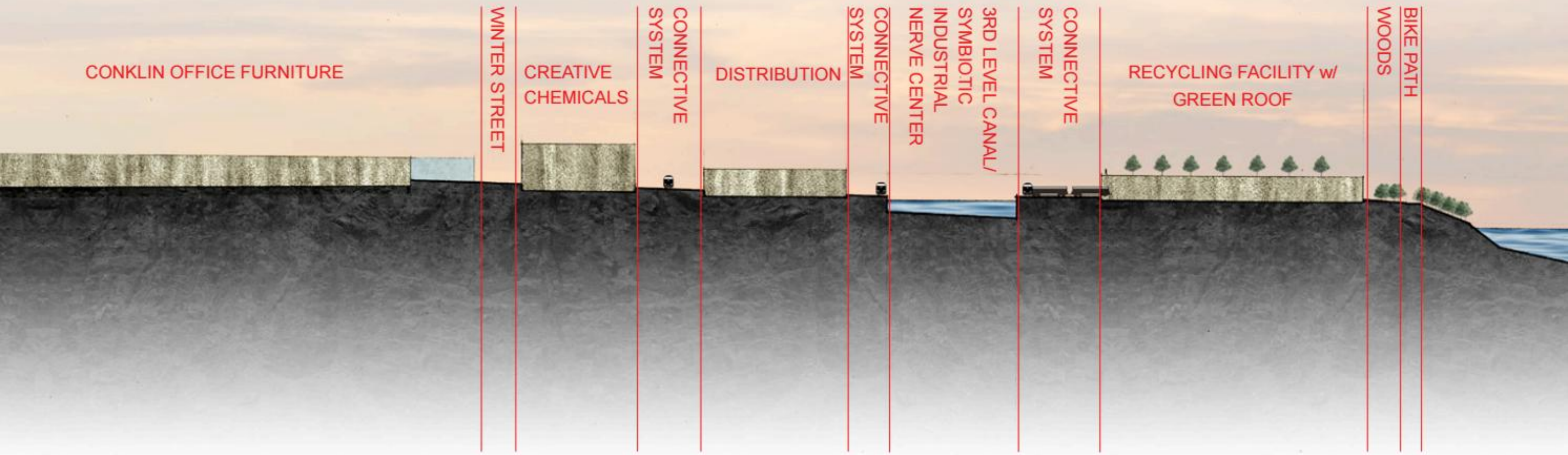
The red cut line through the various buildings, streets, canals, and opens spaces on the preceding spread indicates the location of the section elevation illustrated below.

This drawing illustrates the progression of industrial and recreational programming from northwest to southeast, starting at the Holyoke Heritage State Park and 1st Level Canal and extending to the Connecticut River. This section also includes the 2nd and 3rd Level Canals as well as existing, industrial businesses that are not specifically included as part of the proposed



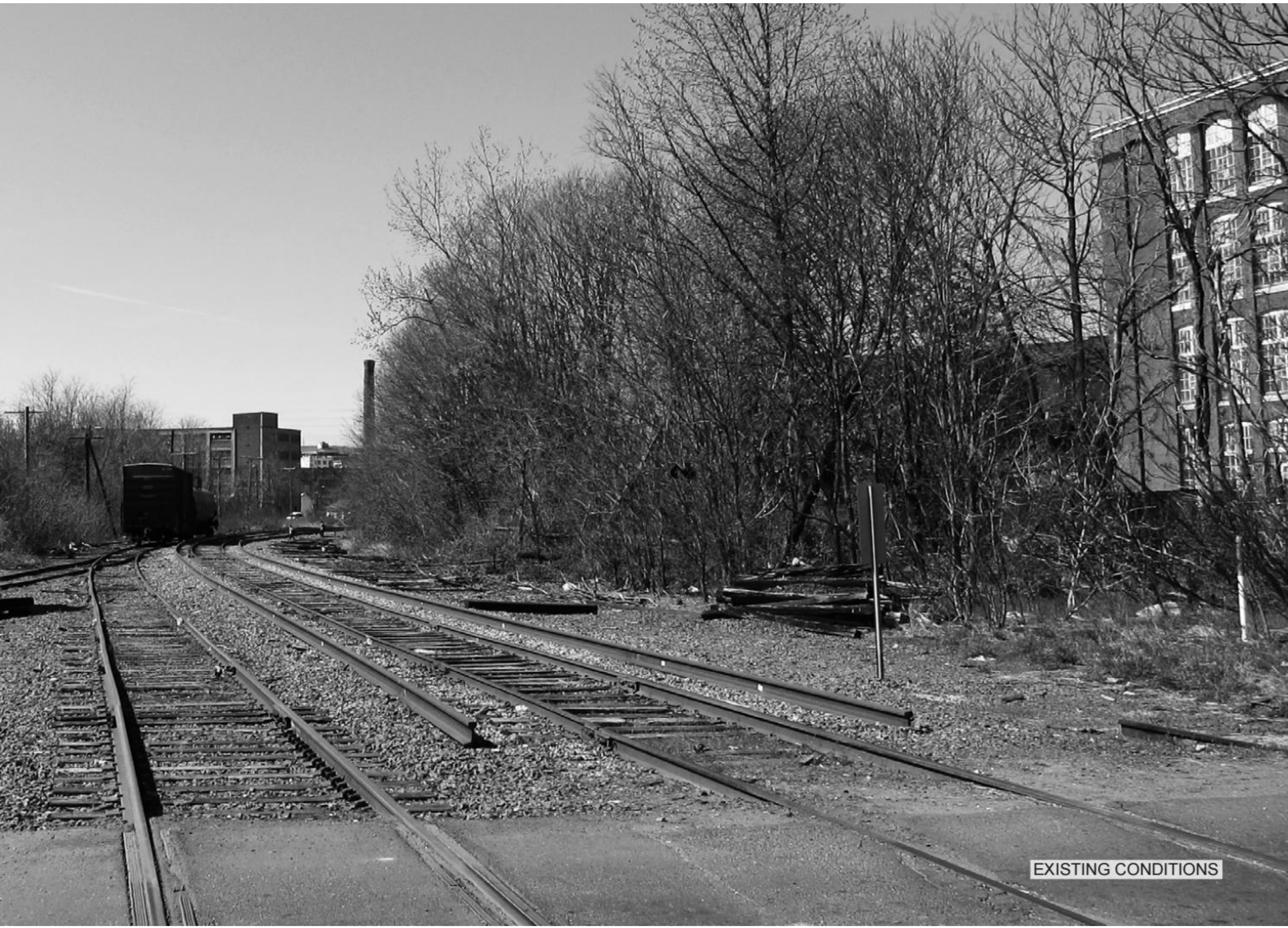
program, but that are nonetheless contextually relevant to the purpose of this thesis.

This section covers a 3600' stretch of land and an approximately 50' change in elevation from the highest point at the Heritage State Park to the lowest point at the Connecticut River. Over the course of that span the cut intersects the Hydro-Park and Beer Garden, the Solar Skate Park and other recreational facilities (hockey rink, basketball courts, and maintenance building), and the full gamut of the Symbiotic Industrial Nerve Center (distribution, recycling, and Connective System).



CONFLUENCE PARK

Confluence Park transforms the existing, unfriendly edge of the Connective System's Central Spine into an engaging, recreational space. It also provides unobstructed, elevated views of the renewed industrial activity and serves as a major facilitator of pedestrian and cyclist movement through Holyoke Center City.


EXISTING CONDITIONS

CONFLUENCE PARK DESIGN

Confluence Park is an expansive piece of landscape architecture that provides a number of unique recreational opportunities to engage with the renewed industrial activity, particularly that of the new train traffic.

The park itself runs parallel to the Central Spine between Appleton and South Canal Streets, essentially forming a very large earth mound. Its orientation allows it to host a 16' wide pedestrian/bicycle path that overlooks the tracks. The path slopes upward at a steady 1.2% till it reaches a viewing platform 23' above existing grade where it then continues as a bridge over the canal and trains below. Both the viewing platform and the bridge provide unobstructed views of the Symbiotic Industrial Nerve Center's bustling train and manufacturing activity. Along its southern-most 300,' the mound's retaining walls also double as rock-climbing surfaces.

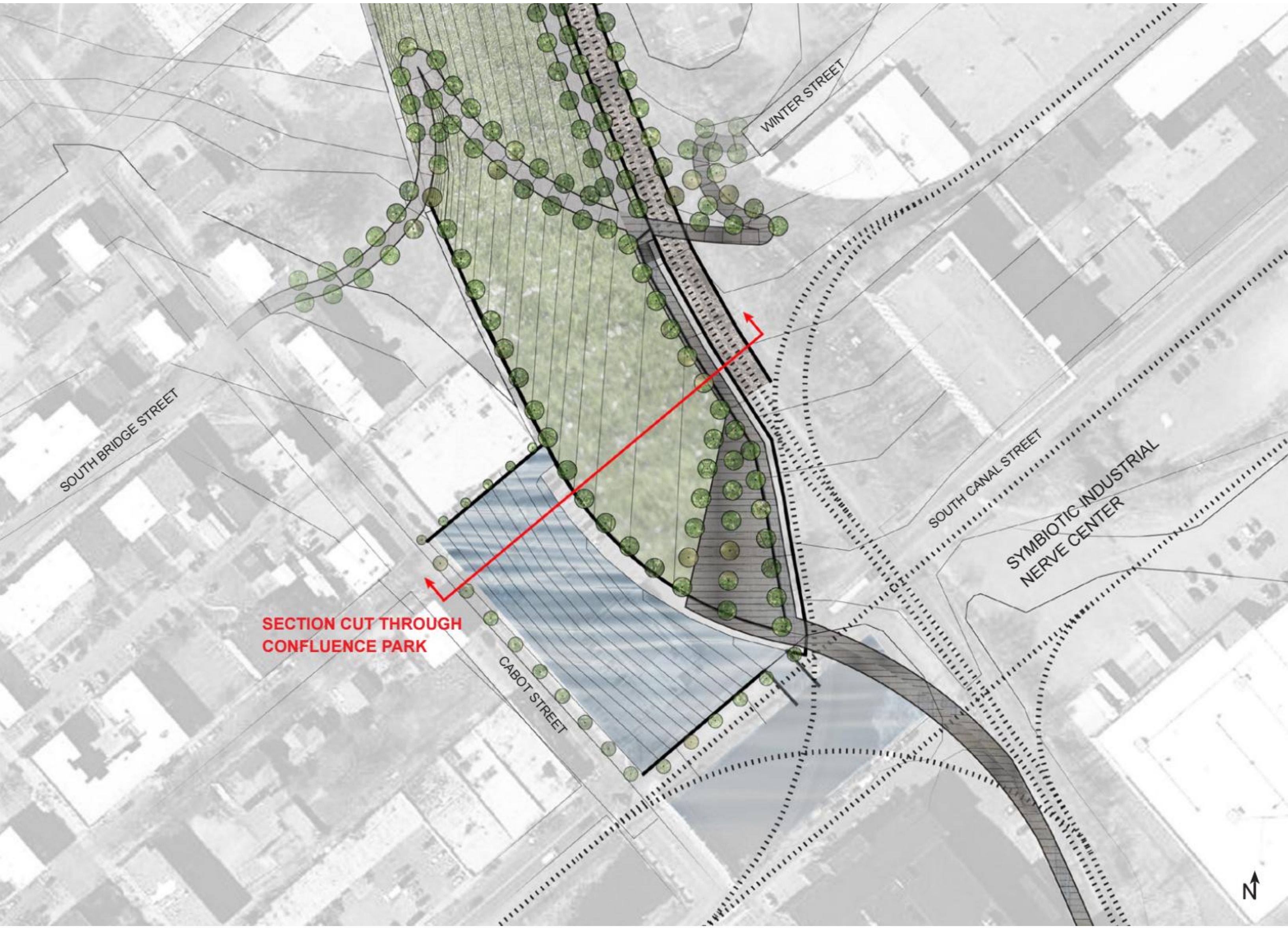
Access to the rock-climbing area is provided by a set of stairs adjacent to the Winter Street bridge. These stairs descend to a grade 9' below that of the regraded Central Spine, providing 28' feet of vertical wall surface at their base. This grade continues to ramp downward towards the south while the mound itself continues to ramp upward, providing an eventual rock-climbing, retaining-wall surface of 34' in height.

The stretch of ground below the tracks that lies to the south of the stairs is carved out to provide a space for rock-climbers to pay their admittance fee, rent rock-climbing equipment, and enjoy refreshments and snacks when not scaling the landscape infrastructure.

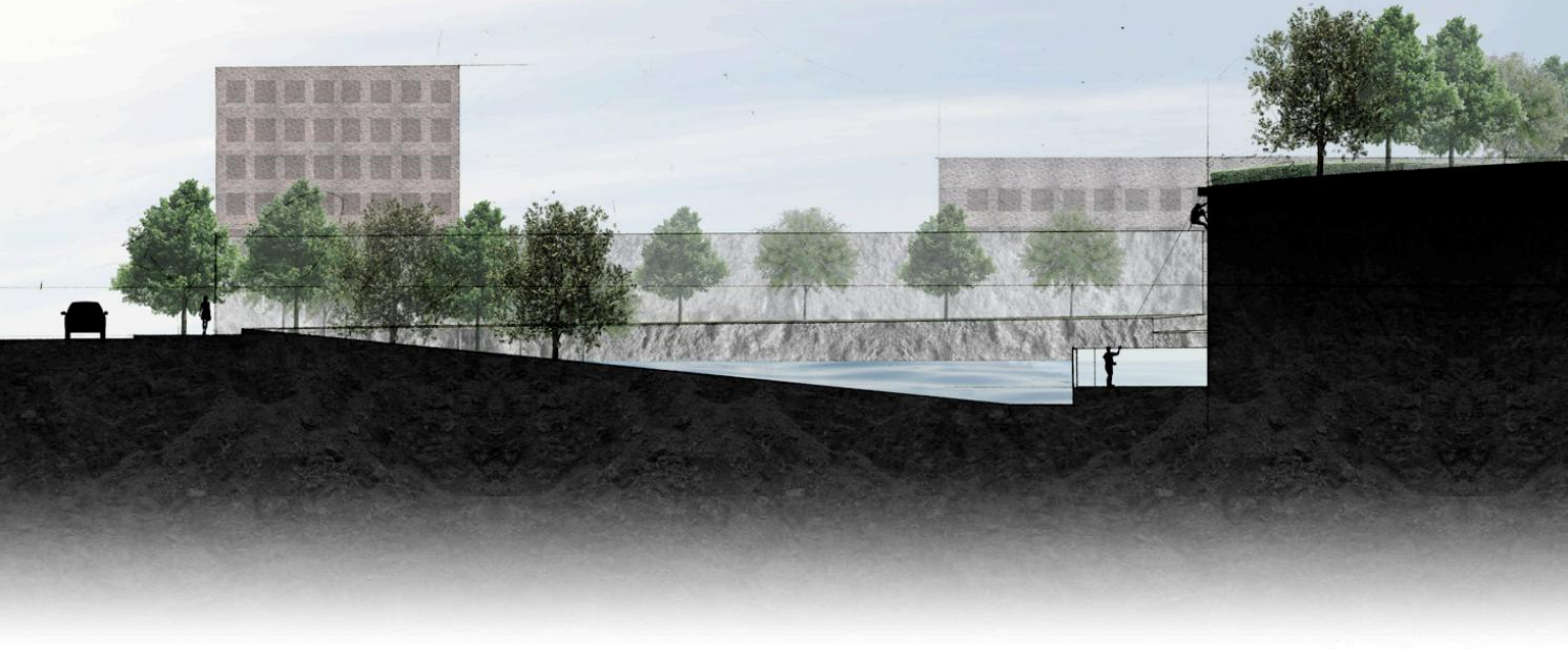
The rock-climbing surface also wraps around the southern edge of the mound where it is greeted by a new water-filtering basin that captures run-off from the mound and feeds directly into the 3rd Level Canal. A durable, transparent wall separates the water from the base of the rock-climbing area, creating a unique, submerged feeling of being truly immersed in the infrastructure of both the canal and the mound.

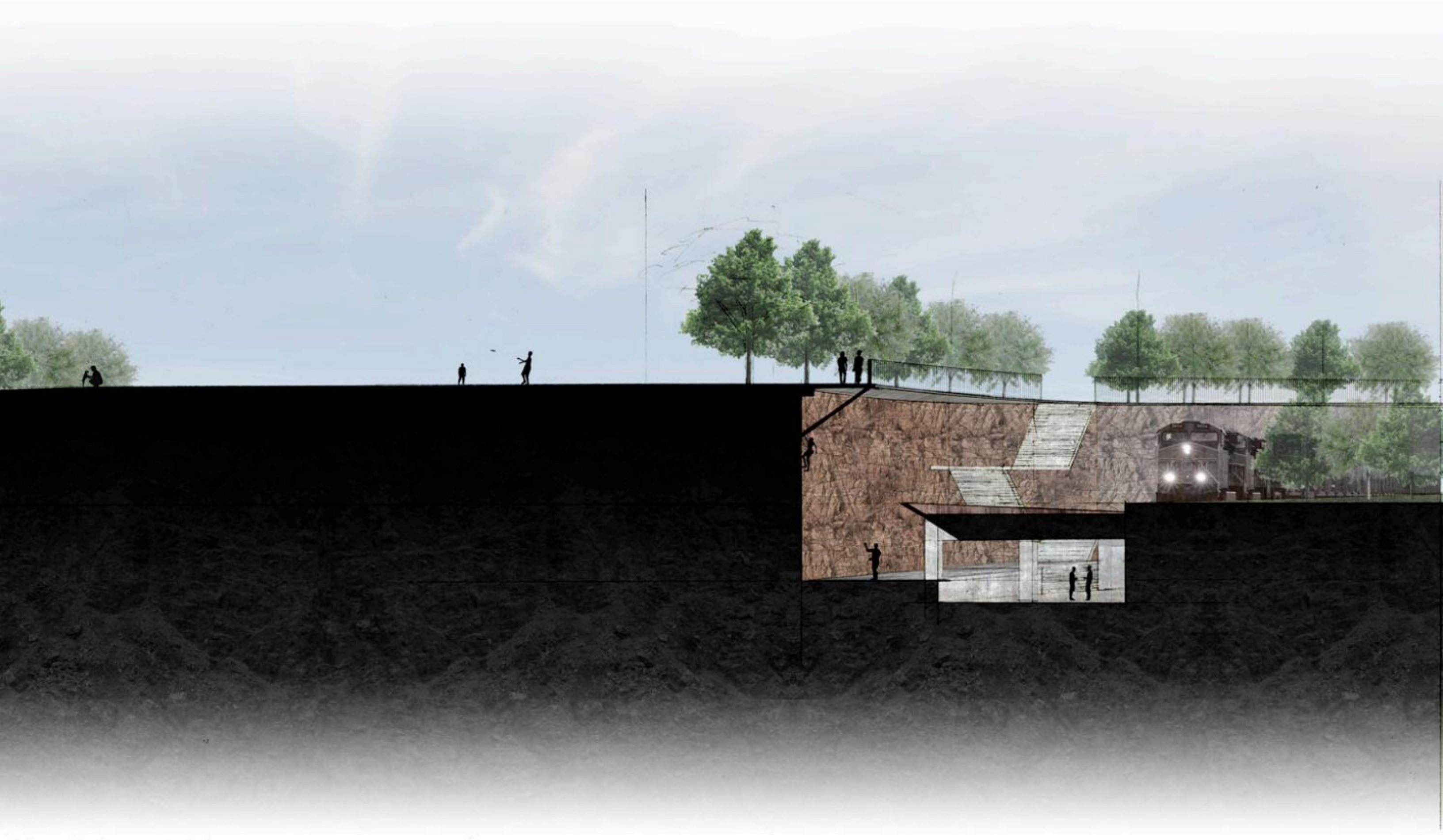
Finally, the park also provides a large, grassy surface approximately 400' by 180' in size, adjacent to the viewing platform and is conducive to playing games of frisbee or catch. The surface nearest the viewing platform features a slope of only 1.5% while the portion furthest from it (and nearest the path leading up from Cabot Street) itself does not exceed 6%. This grassy surface is bounded on one side by the railing of the pedestrian/bicycle path and on the other by a series of trees and a thick hedge.

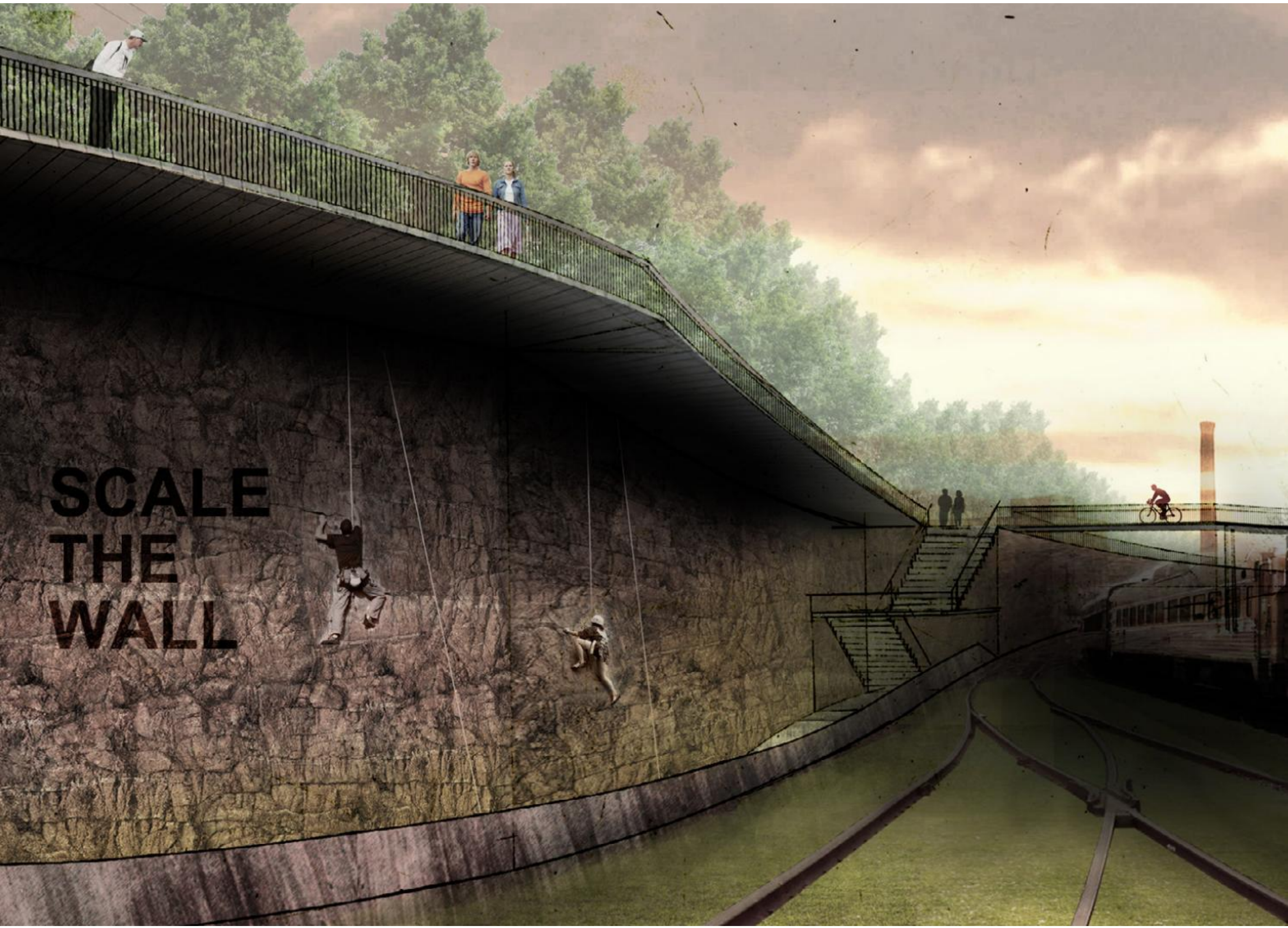
Lastly, the paths leading up from Cabot Street and Winter Street are both graded at 5% to maintain ADA accessibility.


WINTER STREET
SOUTH BRIDGE STREET
SOUTH CANAL STREET
SYMBIOTIC INDUSTRIAL NERVE CENTER
CABOT STREET
SECTION CUT THROUGH CONFLUENCE PARK
N

SECTION CUT THROUGH CONFLUENCE PARK






SCALE
THE
WALL

578
VI
PIONEER VALLEY
578
578

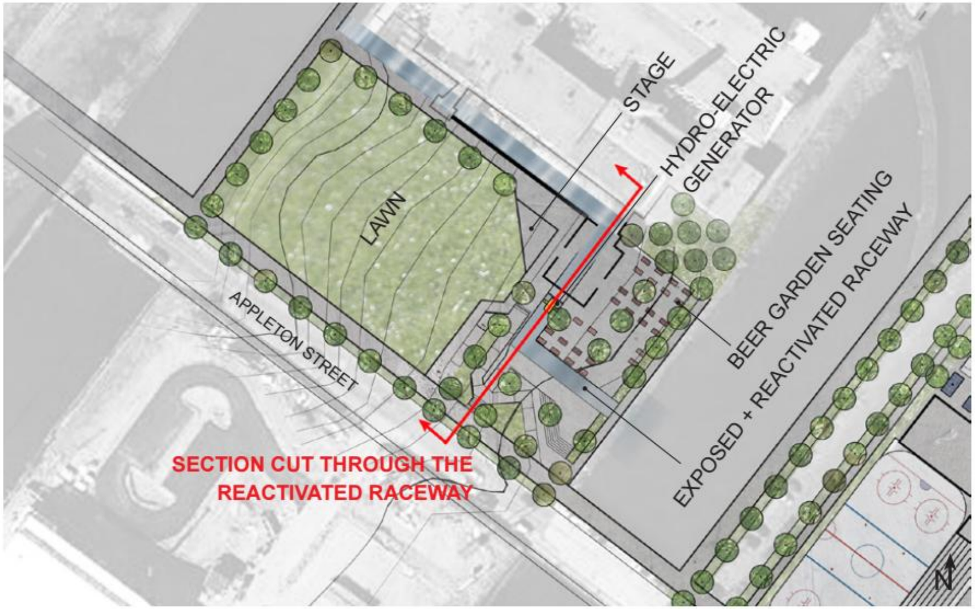
HYDRO-PARK + BEER GARDEN

The Holyoke Hydro-Park and Paper City Beer Garden occupy prime real estate in the city. Nestled between the 1st and 2nd Level Canals, the Hydro-Park reactivates a dilapidated, weed-clogged raceway for small-scale hydro-electric generation. People gain a better understanding of hydropower and enjoy a nice summer's day with some live music and a fresh brew.

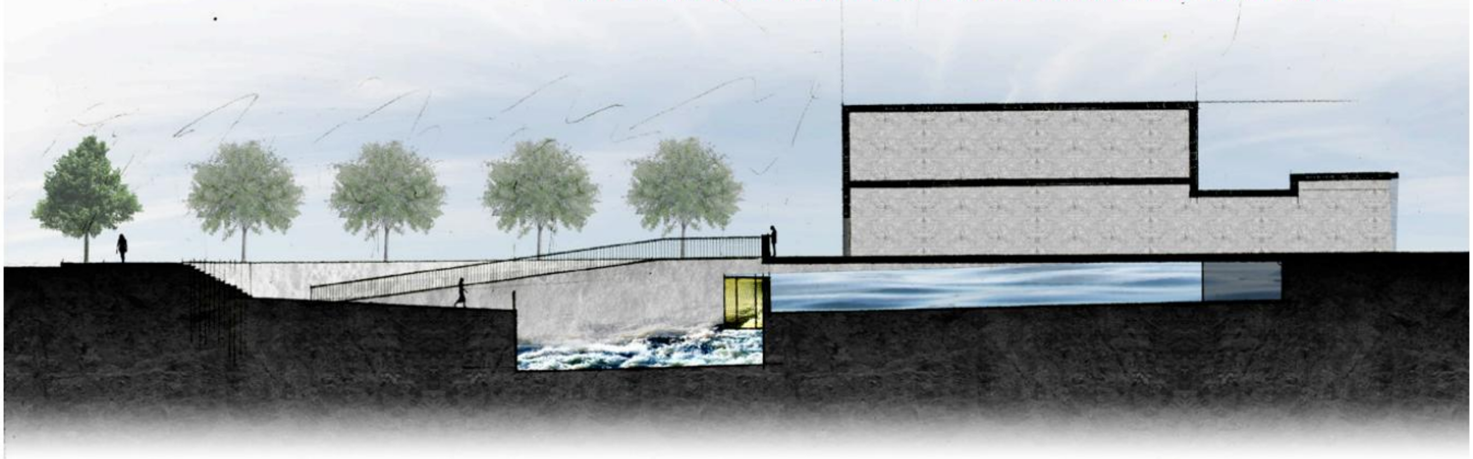
EXISTING CONDITIONS

HYDRO-PARK + BEER GARDEN DESIGN

Located across the 1st Level Canal from the Holyoke Heritage State Park, the Hydro-Park is a pleasant, open space that highlights the potential hydropower of a reactivated raceway. The exposed raceway is regraded and controlled with a gate to create the largest head of water possible at its point of fall. A hydro-electric generator is equipped at this point as well, allowing visitors to the site the opportunity to view water-powered electrical generation in action. An overlook


STAGE
HYDRO-ELECTRIC GENERATOR
LAWN
BEER GARDEN SEATING
EXPOSED + REACTIVATED RACEWAY
APPLETON STREET
SECTION CUT THROUGH THE REACTIVATED RACEWAY
N

SECTION CUT THROUGH THE REACTIVATED RACEWAY



platform allows people the opportunity to watch the fall from above, while a series of stairs and ramps graded at a 5% slope allow people the opportunity view it head-on at a lower elevation.

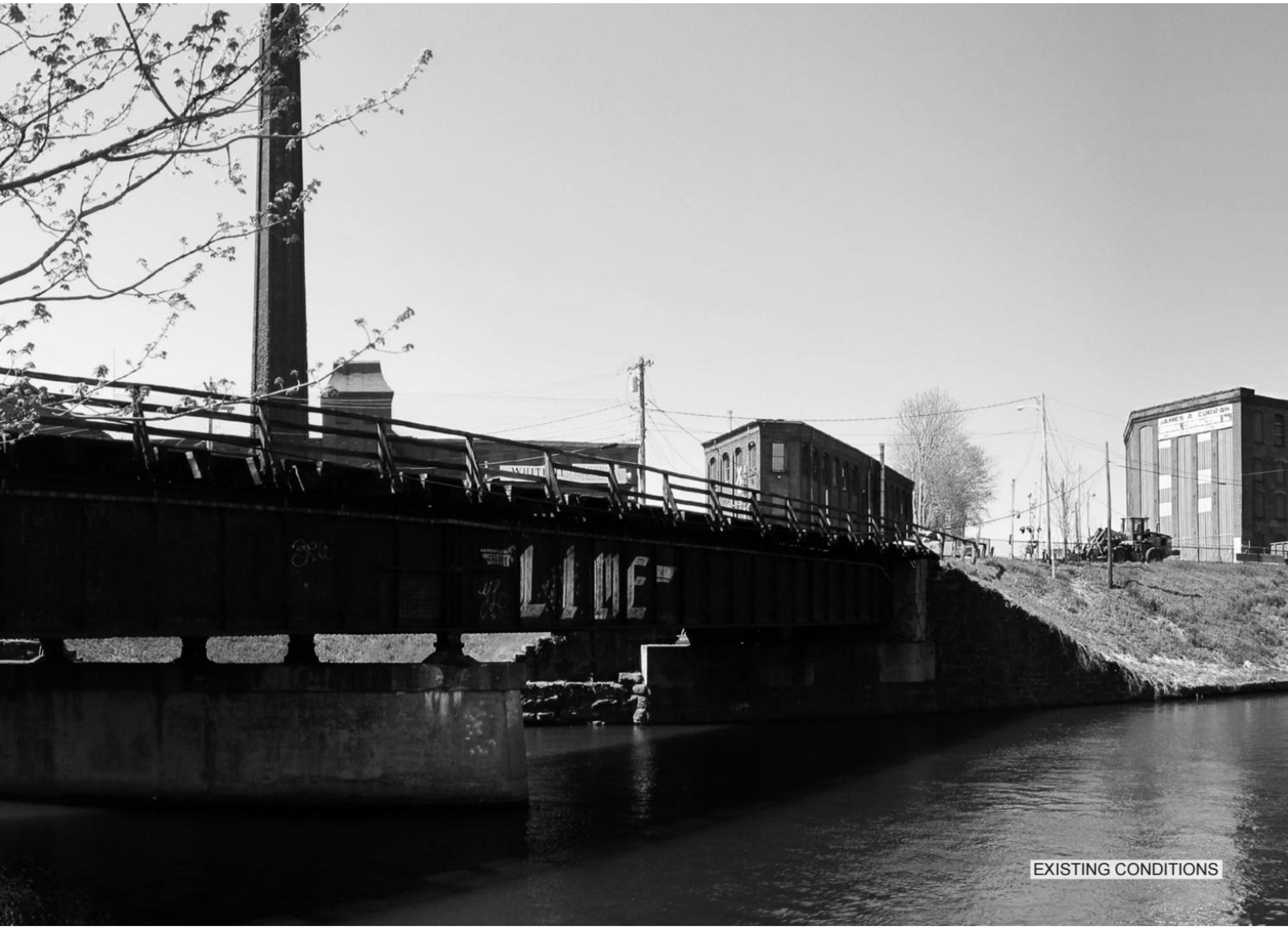
Because the Hydro-Park is situated on predominately vacant land, it also becomes a good site for a summer concert venue with the audience viewing space becoming a gradually sloping lawn facing the stage. The stage is nestled between the raceway and the one building on site, which in turn plays host to a beer garden with outdoor seating alongside the 2nd Level Canal. The site is a prime location to be serviced by Holyoke's own Paper City Brewing Company, which is less than a quarter of a mile away.

In addition to the preceding spread, this site may be seen in its present condition on page 45.

FEEL THE BUZZ

GATEHOUSE BRIDGE

The Gatehouse Pedestrian/Bicycle Bridge is smaller in scale than either Confluence Park or the Hydro-Park, but nonetheless important because it facilitates new movement across the 2nd Level Canal, past the existing gatehouse, and to the Hadley Falls Power Station. It also connects to the new train station and commuting hub surrounding it.



EXISTING CONDITIONS

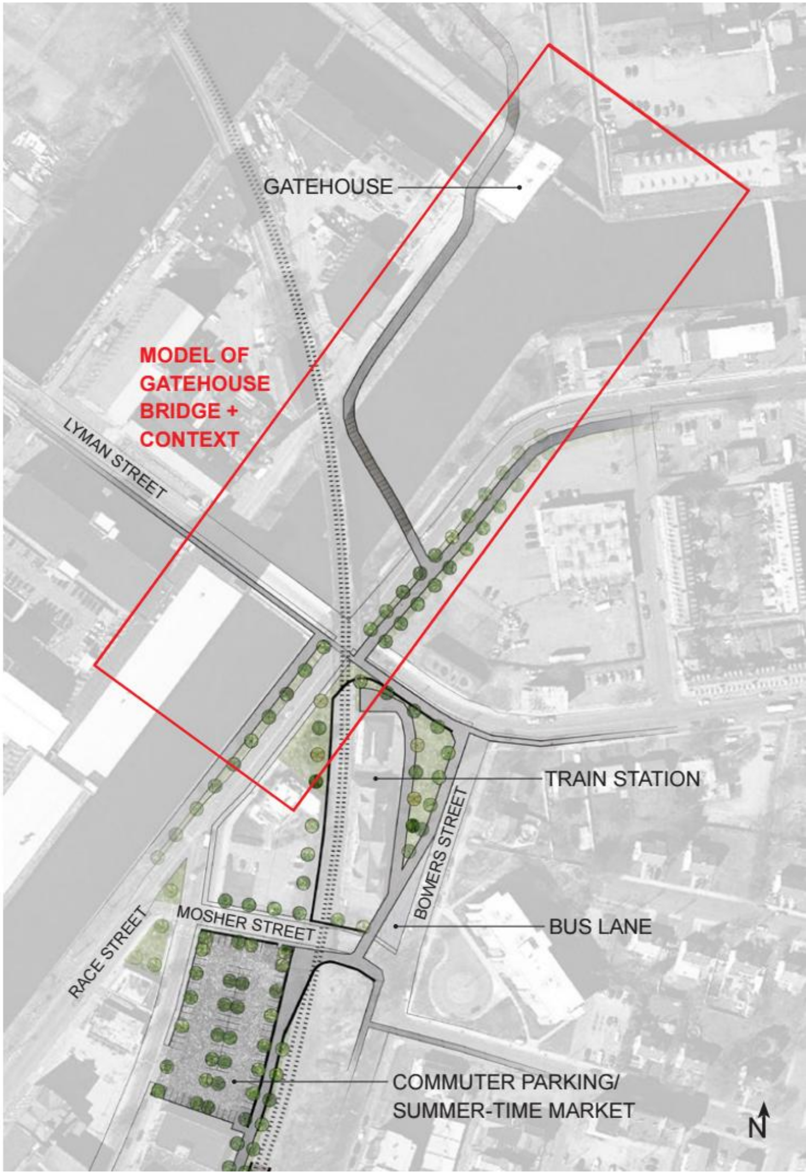
GATEHOUSE BRIDGE DESIGN

As part of the intention to increase mobility and opportunities for engagement with Holyoke's industrial landscape infrastructure, a new pedestrian/bicycle bridge is proposed that spans the 2nd Level Canal near the existing train bridge. This new Gatehouse Bridge not only brings people into close contact with both the trains and the canal, but also provides unprecedented access to the gatehouse and the lock that separate the 1st Level Canal from the 2nd Level Canal. Beyond the gatehouse, the path continues north to the dam at Hadley Falls where it then turns towards the east and continues along the riverfront as indicated in the planning diagram on page 83.

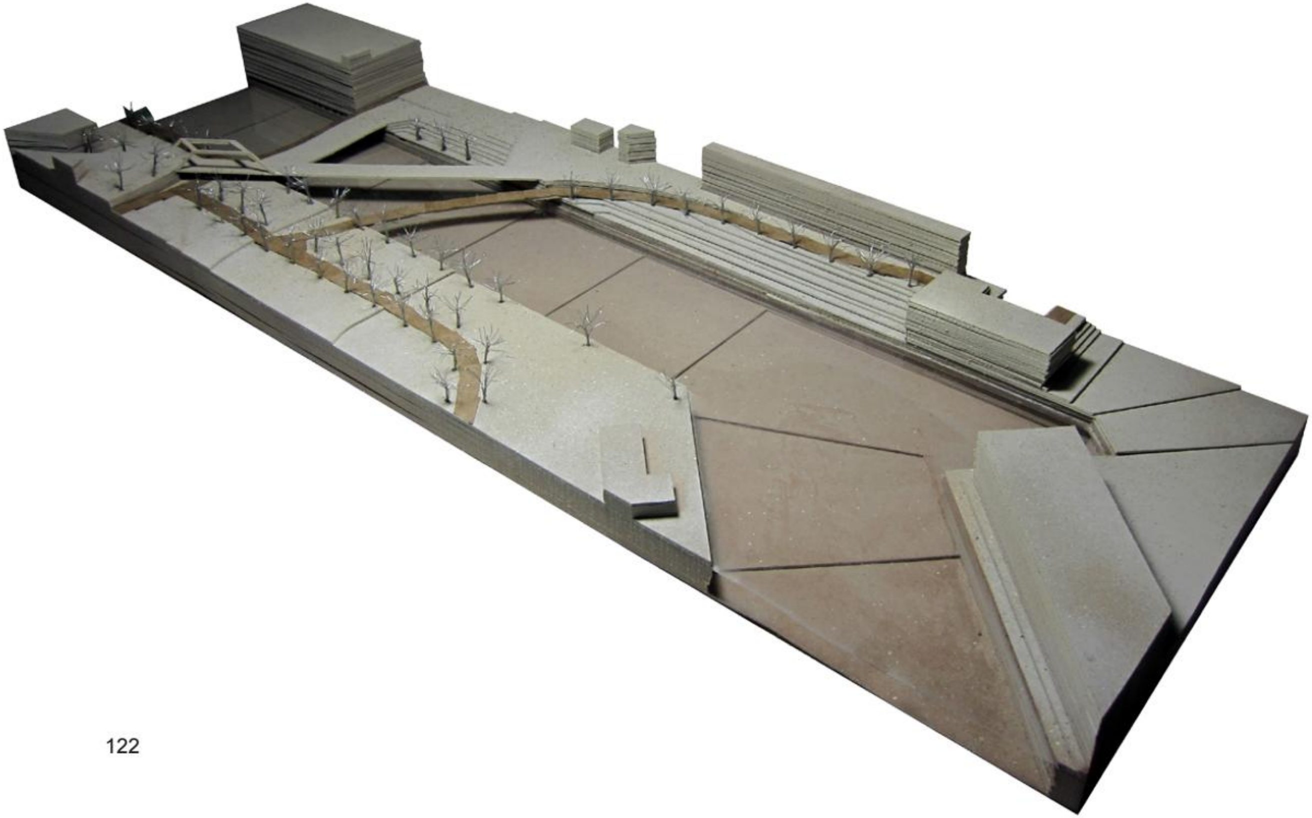
Also of note is the fact that the northern bank of the 2nd Level Canal is substantially higher than the southern bank, so Gatehouse Bridge ramps upward at a slope of 3% to meet the existing grade on the northern bank.

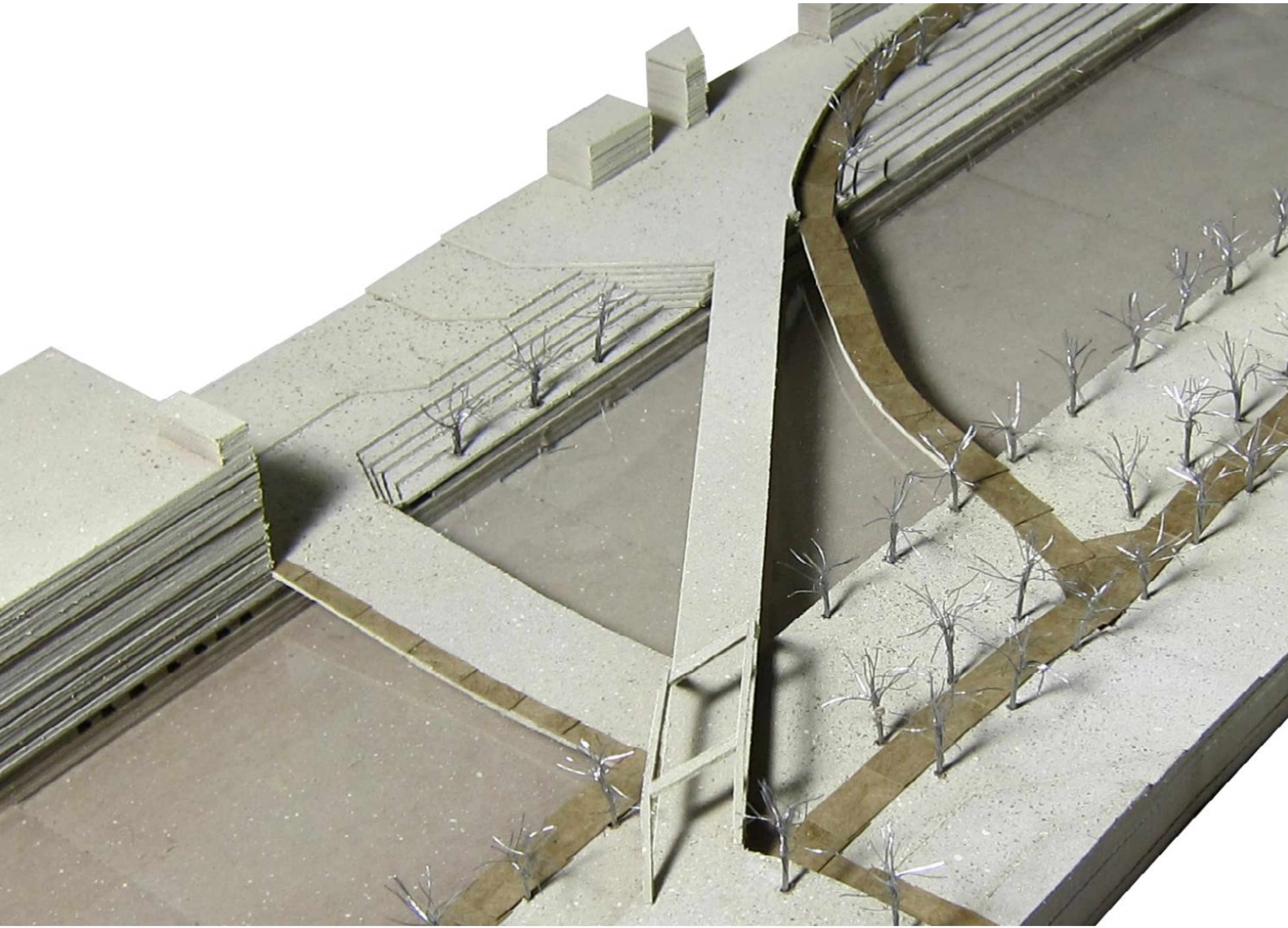
This new bridge is also near the future train station, so it further reinforces the notion of this area becoming a transit focal point.

Lastly, because the intersection of Lyman and Race Streets is three-dimensionally complicated (vehicular and train traffic overlap at different heights), the entire stretch was explored in model as indicated in the drawing on the opposite page.


GATEHOUSE
MODEL OF GATEHOUSE BRIDGE + CONTEXT
LYMAN STREET
TRAIN STATION
BOWERS STREET
MOSHER STREET
RACE STREET
BUS LANE
COMMUTER PARKING/ SUMMER-TIME MARKET
N

MODEL OF GATEHOUSE BRIDGE AND CONTEXT



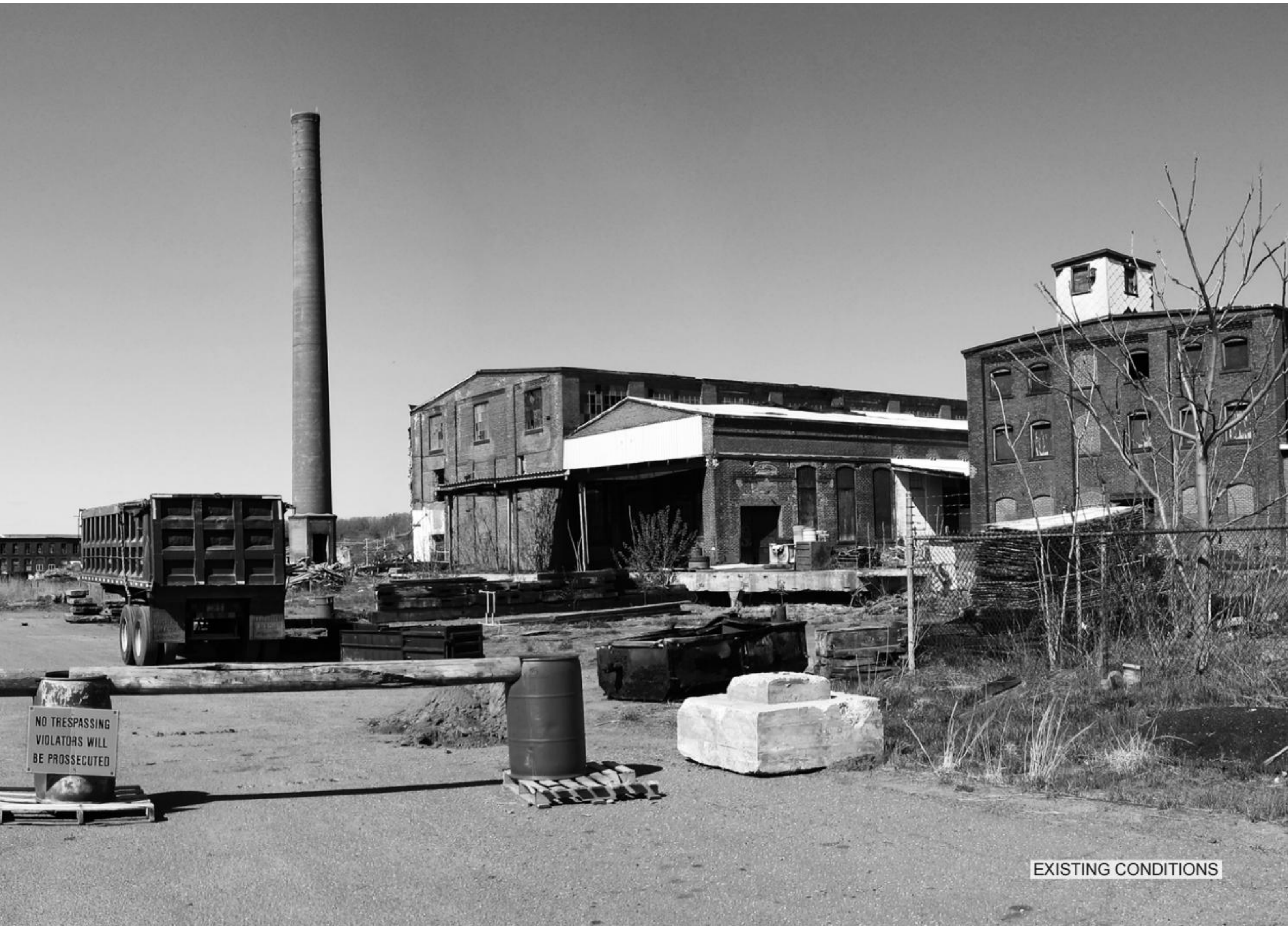


INDUSTRIAL RUINS PARK

Industrial Ruins Park lies wedged between the 3rd Level Canal and the Connecticut River and thus somewhat beyond the boundary of where the design work for this thesis focused most. It nonetheless remains an intriguing site with high potential—pending remediation, of course.

It is also of unique interest because it is the one site of all those addressed within this thesis that was specifically identified for a historical preservation and commemorative use, rather than a renewed industrial or research and development use. The rationale behind this can best be seen in the diagrams on pages 85 and 89 where industrial zoning is moving south and residential zoning is moving north, and this site falls within the more residential zone. Plus, this site would provide excellent access to the river for the local residents, in addition to preserving the memory of Holyoke's industrial rise and fall.

Properly designing this site in plan and section fell outside the scope and time frame of this thesis project, but an optimistic idea of what it could become is shown on the following spread.



EXISTING CONDITIONS

RIDE THE SLUICE

EVALUATION + CONCLUSION

"...there are the usual business **reasons industrial symbiosis projects might not be attractive**, based on barriers any venture faces: risk, finance, mobility of capital, or the availability of higher pay back options elsewhere."

–Marian Chertow, *Industrial Symbiosis: Literature and Taxonomy*

RECONSIDERING THE MACHINE'S REANIMATION

In attempting to design a flexible platform for industrial symbiosis to take root, I was lucky (and I would also like to think strategic) in selecting Holyoke as the test site. Holyoke fit the bill perfectly: plenty of abandoned land/buildings, substantially deindustrialized but with some industrial production still scraping by, excellent access to rail lines and freeways, many site-specific opportunities for clean energy generation, and close proximity to major research institutions. Additionally, the city had just completed a brand new masterplan entitled *Connect. Construct. Create.* in December of 2012, so I was able to rely on data that was only one month old when I began researching Holyoke in January of 2013 (and the other documents that had informed the plan contained data only several years old at most themselves). In a sense, by selecting Holyoke as my test site, the task was made easier than it might have been had I chosen a site with fewer inherent, compatible qualities for industrial symbiosis or with less recent, formal research conducted regarding its current status.

That said, the approach I took towards siting the thesis project in Holyoke would be relevant in approaching any other site with the same intentions. Industrial symbiosis is inherently site-specific, so a deep site analysis aimed at uncovering existing industrial activity and areas for potential symbiotic growth would be a major first step regardless of the chosen site. And some sites might not lend themselves well to that goal; if the necessary precursors for industrial symbiosis do not already exist at the site, then the cause would in all likelihood become a lost one. The existing site conditions absolutely must inform the program in an industrial symbiosis project. Program cannot be determined prior to site analysis and its associated uncovering of existing industrial activity, exchange networks, and their potential for expansion. The take-away lesson is universal in the approach towards site analysis, rather than in the siting and adjusting of a particular, desired program on any given site regardless of the site conditions.

Because the industrial program can only be determined following site analysis, the recreational program can then only be determined following the determination of the industrial program. The new and improved industrial sites and flows inform the recreational opportunities that may occur on the infrastructure that emerges. This is another instance where the analytical approach is the take-away lesson that may be applied to other projects of similar intent.

There is no single method for implementing industrial symbiosis at any given site, but there is a good one for gaining a solid understanding of the given site as the first step towards attempting to implement industrial symbiosis.

CONCLUDING REMARKS

In the end I feel that my proposal for reindustrializing Holyoke and creating unique recreational experiences based on that reindustrialization is a sensible one. The integration of industrially symbiotic recycling, clean energy, and transportation infrastructure with improvements to the human experience achieves the goal that I originally intended. However, that does not mean my proposal provides all the answers or comes without its own shortcomings.

In particular, as an economic revitalization strategy (where the underlying goal is to improve the economy in a depressed place), my proposal would require an extreme amount of funding. While some elements of my proposal are not major undertakings, much of it is, and certain infrastructural pieces such as the Confluence Park earth mound and associated below-ground snack bar, while technically feasible, would cost a fortune—so who would pay for all of this?

A phasing strategy would be a logical step towards mitigating the costs of implementation and construction. The nuances of implementing the improved Connective System in conjunction with a recycling facility would seem to me to be a promising starting point, and maybe not necessarily in the locations that I have specified for the initial phase. For example, the building I denoted for distribution could house the recycling facility in its early stages, until such a time that demand requires an enlarged, newer facility be built on vacant land.

The aspects of the proposal relating to increasing hydropower efficiency in conjunction with UMass - Amherst's engineering department would probably be the easiest to implement in terms of physical construction. A test facility at the site of the old Parsons mill would require new construction, but research and development could still operate at the location I designated in the old Farr Alpaca building.

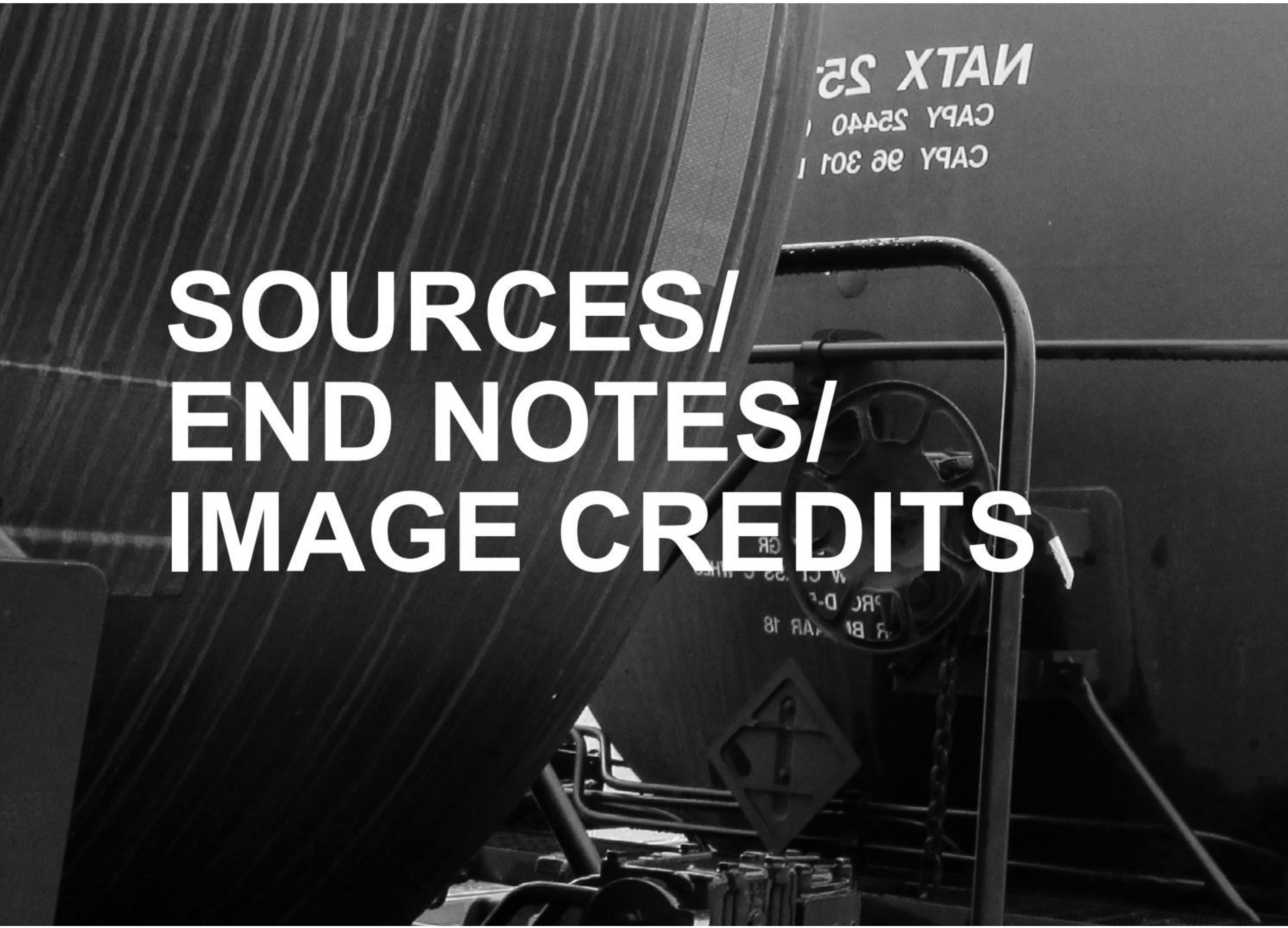
My suggestions for the Hydro-Park and Paper City Beer Garden would also be of relative ease to implement. The site is presently a vacant lot and the millrace running through it is not covered for most of its length, so only some relatively very minor physical changes would be necessary to transform this dirt lot into a pleasant summer-time outdoor space, especially if a less idealized form and grading scheme than those that I designed are realized.

This is not to say that I wish to dilute my proposed designs, but at the same time I am capable of acknowledging instances in which cost may render them impossible.

It should also be noted, that before any of my suggestions could be implemented, remediation would almost certainly need to take place first. Center City in Holyoke is full of brownfields, including an existing tar pit in the river itself, and no development could occur on any of these contaminated sites until treated and deemed safe. (But, as a side note, contaminated soil could be relocated and used to construct Confluence Park's earth mound and capped, so the earth-moving logistics of that piece of the proposal remain physically feasible).

Additionally, further investigation into the actual by-products of the paper converters and other industrial firms would be helpful for future development of this project. I focused on recycling as part of a symbiotic system, but there are many other substances at work that could potentially benefit a symbiotic scheme. Identifying those substances and their potential uses would lay a solid foundation for increasing symbiotic industrial activity beyond recycling and clean energy generation.

Lastly, as the quote on the introductory page of this section suggests, all the best reasons and efforts in the world for developing a symbiotic system may not be enough for one to actually be successful if business interests are stronger elsewhere. In that sense, this thesis provides more of an industrial/infrastructural roadmap towards symbiosis, but the economics of it would need to be addressed by an economic expert to determine feasibility beyond the realm of city planning and landscape architecture.



SOURCES/ END NOTES/ IMAGE CREDITS

END NOTES

1. Page 3: (Chertow, 2000)
2. Page 30: (Green, 1-21)
3. Page 30: (Green, 22-65)
4. Page 31: (Jacobson-Hardy and Weir, online document)

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Page 15. Aerial View of the Kalundborg Symbiosis. Photograph. Den Store Danske. <*http://www.denstoredanske.dk/@api/deki/files/81619/=Asn%25c3%25a6s_lerchen.JPG*> Accessed 6 February 2013.

Page 17. The Steel Yard in Providence. Photograph. Project in Detail: The Steel Yard. <*Steelyard in detail.pdf*> Digital file provided by Kaki Martin from Klopfer Martin Design Group.

Page 19. Landschaftspark Duisburg Nord at Night. Photograph. Landschaftspark Duisburg Nord. <*http://en.landschaftspark.de/website/sites/lapano_en/uploads/documents/der_park/buehne_6-rg_copyright_LPN.jpg*> Accessed 22 January 2013.

Page 23. Fox, Randy. "Last Call." Photograph. American Elegy. <*http://www.americanelegy.com/wp-content/uploads/2012/03/sean-braddock-bar.jpg*> Accessed 4 April 2013.

Page 32. 1870 Map of Holyoke. Property of the Holyoke History Room of the Holyoke Public Library.

The base image shown in the diagrams on pages 39, 41, 43, 46, 47, 51, 68, 69, 71, 73, 75, 77, 79, 81, 83, 85, 87, 89, and 93 were all derived from the Bing Maps' Bird's Eye View of Holyoke, available online at <*http://www.bing.com/maps/*>.

The base images shown in the maps on pages 35, 48-49, and 53 were all derived from MassGIS datalayers, available online at <*http://www.mass.gov/anf/research-and-tech/it-serv-and-support/application-serv/office-of-geographic-information-massgis/datalayers/layerlist.html*>.

The base image aerial photography shown in the diagram on page 37 and the plans on pages 95, 96-97, 100-101, 107, 114, and 121 were culled from Google Earth's geographic viewing software, available online at <*http://www.google.com/earth/index.html*>.

All other drawings, diagrams, photographs, and composite image elements were created by and/or photographed by the author and are the property of the author.

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